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June 5, 2018

Approved By
Asia and Pacific Department

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INFRASTRUCTURE INVESTMENT IN NEW ZEALAND: GAPS AND MULTIPLIER EFFECTS[1]

- **There has been an increased emphasis by the government on spending on infrastructure.** However, it is not clear from a long-term perspective if all of New Zealand infrastructure needs will be met.
- **The infrastructure investment gap to 2040 for New Zealand is quantified in the *Global Infrastructure Outlook* by Oxford Economics and the G-20.** The report estimates New Zealand's average infrastructure investment gap is around 0.3 percent of GDP per year.
- **Closing the infrastructure investment gap is analyzed using ANZIMF (Australia-New Zealand Integrated Monetary and Fiscal model).** It is a version of IMF's GIMF (Global Integrated Monetary and Fiscal model), a micro-founded, overlapping generations dynamic stochastic general equilibrium (DSGE) model, with a role for infrastructure investment.
- **There can be further gains for the New Zealand economy from closing the infrastructure gap.** Infrastructure investment has been demonstrated to be productivity-enhancing, with positive economy-wide spillovers. The long-term real GDP gain can range from 0.65 to 0.8 percent relative to New Zealand's outlook in the *World Economic Outlook*.
- **The range of outcomes is a result of different forms of financing the additional public infrastructure spending.** The least productive financing is personal income tax (crowds out consumption and distorts labor supply) followed by goods and services tax (only crowds out consumption), with deficit financing (which, however, crowds out some private investment) as the most productive.
- **The government can use the closure of the gap to satisfy other fiscal policy objectives:**
  - ***The government could close the gap earlier.*** If the gap was closed by 2027, there would be higher short-term gains in real GDP, with the same long-term gains. This would be subject to the ability to quickly scale up the amount of infrastructure investment.
  - ***The government could take the opportunity to further regional development.*** By providing more funding to regions in need of development than implied by their current shares in GDP, the regions could gain up to an additional 20 percent, translating to 5 percent for New Zealand as a whole.
  - ***The government could aim for higher quality infrastructure investment.*** An illustrative example is presented where New Zealand has Singapore-level quality scores. This could be realized at least in part by a greater use of New Zealand's public-private partnership (PPP) framework.

[1] Prepared by Dirk Muir (APD). The chapter benefited from valuable comments by the Treasury of New Zealand and participants at a joint Treasury and Reserve Bank of New Zealand seminar.

A. Introduction

1. There has been an increased emphasis by the government on infrastructure spending. However, it is not necessarily clear from a long-term perspective if all of New Zealand's infrastructure needs will be met. This paper reports on the current and projected infrastructure investment gap for New Zealand, using the analysis of Oxford Economics, for the Global Infrastructure Hub. Moreover, given the magnitude of the gap, this paper demonstrates that there can be further gains in terms of growth in the near- and medium-term that can be achieved by fully closing said gap, using the IMF's ANZIMF (Australia-New Zealand Integrated Monetary and Fiscal model). These gains can be augmented by focusing on additional fiscal policy choices, such as the time horizon to close the gap, regional development, or the quality of the infrastructure delivered.

2. The extent of the infrastructure investment gap is an important question, because it represents foregone gains in productivity that would allow for higher growth. There is an extensive literature that has demonstrated this theoretically (Aschauer, 1989), empirically (Bom and Ligthart, 2014) and through model simulation and consideration of fiscal policy (Abiad and others, 2016). Much of the literature generally concludes that infrastructure of sufficient quality and quantity can improve the quality of the workforce, the provision of capital, and firms' access to domestic and foreign markets. Interconnectivity is particularly important in a geographically distant country like New Zealand, with concentrated but dispersed population nodes, and without any neighboring, land-connected countries with which to trade. Governments can play an important role in closing the gap, or in encouraging the private sector to do so.

B. A Baseline for the Infrastructure Investment Gap

3. The Global Infrastructure Hub is the primary source in this paper for the baseline infrastructure investment gap. It is a G-20 initiative, that has published a *Global Infrastructure Outlook* authored by Oxford Economics.[2] It forecasts current trends and needs for infrastructure investment until 2040 (a 25-year period, starting in 2016), deriving the infrastructure investment gap from calculating needed spending less spending based on current trends for seven sectors – roads, rail, airports, ports, electricity, telecoms and water – for 50 countries, comprising over 85 percent of global GDP. These seven sectors are considered core infrastructure, which is only a subset of the standard definition of government investment in fixed capital in the national expenditure accounts, as it excludes structures (such as hospitals, police stations, prisons, and schools) and capital equipment (for example, ambulances and police cars, and military equipment).

4. Current trends and needs for the future are determined from extensive calculations. Current trends for infrastructure investment extrapolate spending trends to 2040 through a

[2] The report is the flagship publication for the Global Infrastructure Hub based in Sydney, Australia, and published on-line at https://www.gihub.org/. The report's author, Oxford Economics, is a private, global economics consulting firm, focusing on macroeconomic forecasts. Oxford Economics and the Global Infrastructure Hub, *Global Infrastructure Outlook: Infrastructure Investment Needs, 50 Countries, 8 Sectors to 2040*, can be found at https://outlook.gihub.org/ (for the both database and the report).

thorough analysis of the data for each country, combined with regression analysis for each of three groups of countries (low and lower middle income, high middle income, and high income). Infrastructure needs are computed for each of the seven sectors so that a country will match the 75th percentile of current trends infrastructure stock per capita in their income group, adjusted for quality considerations. Box 1 gives a more detailed explanation of the methodology.

Box 1. The Six Step Methodology of the Global Infrastructure Outlook

1. Compute the seven infrastructure stocks on a per capita basis for 2015 for all the countries in an income group (such as the high-income group, to which belongs New Zealand.

2. Estimate single-equation models for each of the seven sectors using panel estimation, with a set of explanatory variables usually drawn from a subset of GDP per capita, the manufacturing and agricultural shares of GDP, population density, and the urban share of population, plus country-specific fixed factors.

3. Given the forecasts of the explanatory variables, forecast infrastructure stocks per capita to 2040. These are then converted using perpetual inventory equations of the form $K_t = K_{t-1}(1-\delta) + I_t$ to calculate the ***current trend investment*** for each of the seven sectors.

4. Using the single-equation models, estimate what the value of the stocks should have been in 2015 given explanatory variables, to compute the expected infrastructure stock per capita.

5. Using the infrastructure quality measures for each country (from the World Economic Forum's *Global Competitiveness Report 2014-15*), derived a quality-adjusted expected infrastructure stock per capita.

6. Compare the quality-adjusted expected infrastructure stock per capita across countries in a country grouping, to determine the 75th percentile, from which comes for each country, in combination with the perpetual inventory equation, its ***investment needs***.

Infrastructure investment gap = investment needs – current trends in investment

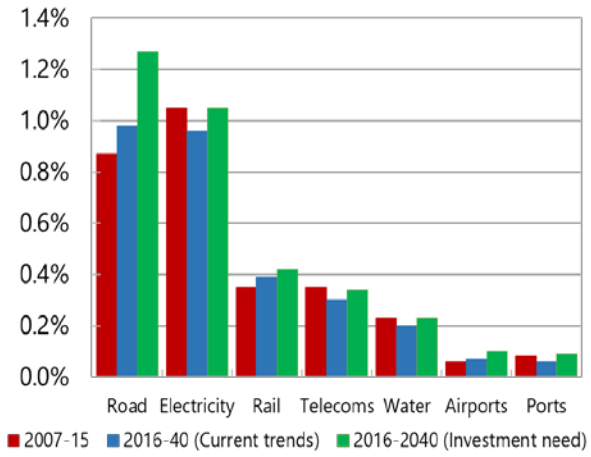
5. The global infrastructure investment gap is estimated at 2015 US$94 trillion between 2016 and 2040. [3] This is a gap of 19 percent against the current trend investment in infrastructure extrapolated to 2040, an average of 2015 US$3.7 trillion per year. It implies that global infrastructure investment spending as a share of GDP should be 3.5 percent now, versus 3.0 percent actual. All the infrastructure sectors have higher needs than current trends, roads being the greatest (Figure 1).

6. New Zealand has a small gap, but not relative to many other advanced economies. According to the *Global Infrastructure Outlook,* New Zealand's overall gap from 2016 to 2040 is roughly 9.5 percent of GDP, implying cumulative infrastructure investment needs of 2015 US$190 billion, versus the current cumulative trend spending of 2015 US$171 billion. This translates into an infrastructure investment spending gap of almost 0.3 percent of GDP per year until 2040, smaller

[3] Values in level terms are in constant 2015 U.S. dollars, abbreviated as 2015 US$.

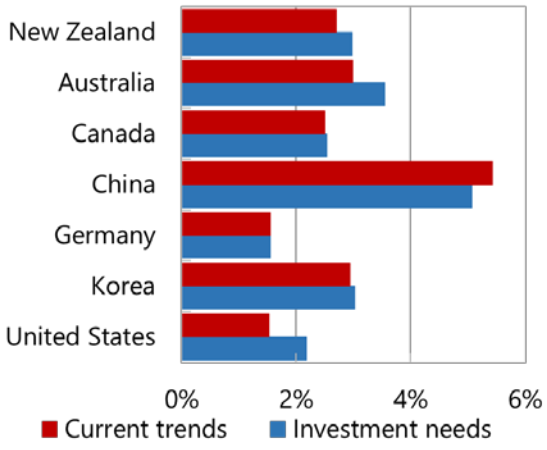
than Australia and the United States, but larger than other key advanced economies and China (Figure 2).

Figure 1. Global Infrastructure Needs versus Trends and Historical Averages
(Percent of global GDP per year)



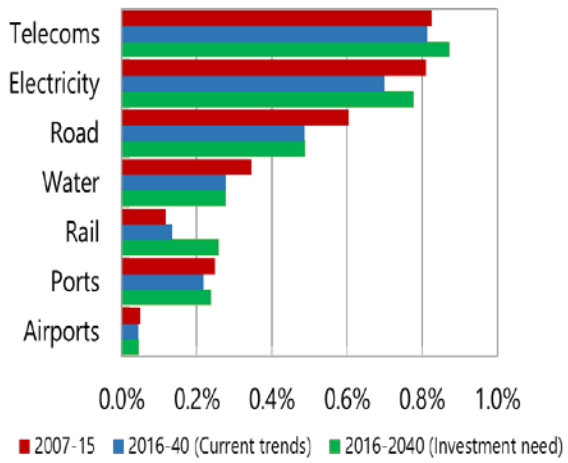
Source: *Global Infrastructure Outlook*, Oxford Economics.

Figure 2. Infrastructure Needs versus Comparators
(Percent of GDP per year)



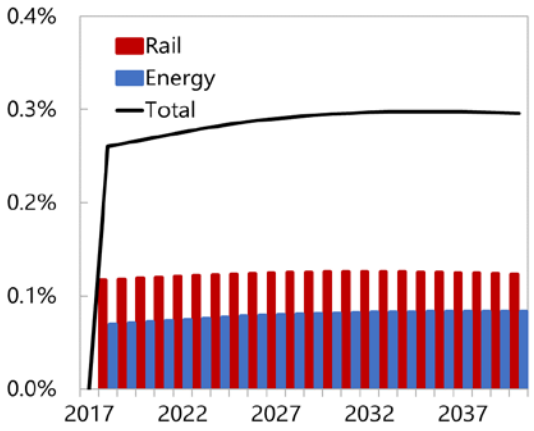
Source: *Global Infrastructure Outlook*, Oxford Economics.

Figure 3. Infrastructure Components
(Percent of GDP per year)



Source: *Global Infrastructure Outlook*, Oxford Economics.

Figure 4. Infrastructure Investment
(Percent of GDP)



Sources: *Global Infrastructure Outlook*, Oxford Economics; and IMF staff calculations.

7. New Zealand's infrastructure investment gaps for the seven sectors differ from the global picture (Figure 3). There has been extensive investment in roads, and current trends continue

to indicate this to be the case, matching the investment needs. Stronger needs exist in the rail and electricity sector, since New Zealand historically has had weak rail linkages (because of difficult terrain on each island with small inland populations). There is also a recognized need to upgrade and expand the power grid.

8. An aggregate infrastructure investment gap as a share of GDP is constructed from 2018 to 2040 (Figure 4). It uses the forecasts for GDP from the IMF's *World Economic Outlook, April 2018* (WEO) and infrastructure investment from the *Global Infrastructure Outlook*. The increased spending in the FY2016/17 fiscal outcomes and FY2017/18 fiscal budgets are roughly consistent with closing the gap in 2016 and 2017, so the gap used here is zero in 2016 and 2017. The gap from 2018 forward for New Zealand differs slightly from that of the *Global Infrastructure Outlook* as nominal GDP growth is more variable in the WEO until 2023, and then slightly higher thereafter. The two most important gaps are in rail (over 0.1 percent of GDP year) and electricity (almost 0.1 percent of GDP per year).

9. However, the measurement of the gap by this methodology should be treated with care, especially since it may not account for risks specific to New Zealand. This sectoral analysis has its limitations, being based strongly on an econometric methodology. The actual measured gaps would also be affected by project-specific analysis of the benefits and costs necessary to confidently determine the prospective gains from further infrastructure investment. Overall, risks are such that the baseline measure of the infrastructure gaps is a most likely a low estimate. They also relate to the current split between the three major urban areas – Auckland and its satellites, Hamilton and Tauranga; Wellington and its suburbs; and Christchurch – and the rest of country, often referred to as "the regions," with particular ones in need of development as they have less and lower-quality infrastructure, fewer employment opportunities, and/or greater inequality and poverty. There are three of these risks, which are interrelated and therefore reinforce one another:

- ***Water-related infrastructure (for the "three waters," potable, waste and storm) has often reached the end of its useful life.*** This is particularly true in the regions, and may not be accurately reflected in the service-life data from the advanced economies used to construct the depreciation rates for water infrastructure. Local governments are most likely falling behind on their maintenance needs, currently underspending capital budgets by up to 30 percent (Controller and Auditor-General, 2017).

- ***The estimates of population growth for the baseline gap is based on historic norms.*** However, net migration has been at record highs for a sustained period of time, since 2014. Repeatedly, expectations that net migration would begin to decline to historic norms have been dashed, and the upside risk that net migration may not return to its historical average soon is still very much in play.

- ***The placement of infrastructure is based on current patterns of urbanization.*** Most infrastructure needs are assumed to be in the three major urban areas, following historic trends, requiring mostly new infrastructure. However, a possible solution is to encourage more population growth in the regions in need of development. These regions' infrastructure needs

would be greater, as they are more isolated, have less existing infrastructure to serve as a kernel for new construction, and have more infrastructure in need of improvement, in comparison to adding or rebuilding neighborhoods in the major urban areas.

C. Benefits from Closing the Infrastructure Investment Gap

10. There are benefits to closing the gap for New Zealand. These benefits can be quantified with the help of ANZIMF, which a version of the IMF's GIMF (see Box 2 for further details).

Box 2. ANZIMF – The Australia-New Zealand Integrated Monetary and Fiscal Model

ANZIMF is an annual, multi-region, micro-founded general equilibrium model of the global economy. It is based on the IMF's Global Integrated Monetary and Fiscal model (GIMF), with supporting documentation that is broadly applicable to ANZIMF (Kumhof and others, 2010, and Anderson and others, 2013). Structurally, each country/regional block is close to identical, but with potentially different key steady-state ratios and behavioral parameters. This exercise focuses on New Zealand, and the fiscal block.

Consumption dynamics are driven by saving households and liquidity-constrained (LIQ) households. Saving households face a consumption-leisure choice, based on the overlapping generations (OLG) model of Blanchard (1985), Weil (1989) and Yaari (1962) where households treat government bonds as wealth since there is a chance that the associated tax liabilities will fall due beyond their expected lifetimes, making the model non-Ricardian and endogenizing the long-term determination of the real global interest rate to equilibrate global savings and investment. The real exchange rate serves to adjust each country's saving position (its current account and associated stock of net foreign assets) relative to the global pool. LIQ households cannot save, consuming all their income each period, amplifying the model's non-Ricardian properties in the short term.

Private investment relies on the Bernanke-Gertler-Gilchrist (1999) financial accelerator. Investment cumulates to the private capital stock for tradable and nontradable firms, which is chosen by firms to maximize their profits. The capital-to-GDP ratio is inversely related to the cost of capital, which is a function of depreciation, the real corporate interest rate, the corporate income tax rate, and relative prices, and an endogenously determined corporate risk premia.

Government absorption consists of exogenously determined spending on consumption goods and infrastructure investment. Both affect the level of aggregate demand. Spending on infrastructure cumulates into an infrastructure capital stock (subject to constant but low rate of depreciation of 5.3 percent). A permanent increase in the infrastructure capital stock permanently raises the economy-wide level of productivity. The calibrated output elasticity with respect to core infrastructure capital is 0.170 (Bom and Ligthart, 2014).

Trade is tracked bilaterally between all regions. There are flows for goods, services, and commodities, and they react to demand, supply and pricing (i.e. the terms of trade and bilateral real exchange rates) conditions. Commodities trade, and its related demand and supply equations, are based on food products, as New Zealand has strong exports for dairy products, meat, and kiwi fruit.

The nominal side of the economy depends on implicit Phillips' curves and monetary policy. The core price is the consumer price index, CPI, while relative prices mimic the structure of the national expenditure accounts. There is also wage inflation, which is implicitly a key driver for CPI inflation. In the short term, the nominal side of the economy is linked to the real side through monetary policy, which is conducted under a

Box 2. ANZIMF – The Australia-New Zealand Integrated Monetary and Fiscal Model (concluded)

CPI inflation targeting regime, where with an interest rate function returns expected inflation to target over several years.

Fiscal policy is driven by a sufficiently detailed government sector that can reproduce simplified fiscal accounts for each country. Fiscal policy aims to maintain a debt target (expressed in flow space as a deficit target) using at least one of seven policy instruments. On the spending side, these are government consumption, spending on infrastructure spending, general lumpsum transfers to all households (such as pensions, aged care provisions, unemployment insurance) and lumpsum transfers targeted to LIQ households (such as welfare, certain pensions). On the revenue side, there are taxes on consumption (the goods and services tax, GST), personal income (PIT) and corporate income (CIT).

The government does not have to be the sole supplier of infrastructure investment. Nontradable firms can be in public-private partnerships (PPPs), by diverting some of their investment into the infrastructure capital stock, which will still register in the national expenditure accounts as private business investment. Firms can either be repaid for their expenses in the future by the government or through a revenue stream. The revenue stream option does not appear explicitly in the model, since it is merely a circular reshuffling of a user fee from households to firms, which would then return to households, as owners of the firms. The government can also provide equity investment injections into the private sector, which will then be converted by firms over some pre-determined time horizon into private business investment, that will contribute to the infrastructure capital stock rather than the private business capital stock.

11. Any additional infrastructure spending requires financing. There are two feasible financing choices for the government – increasing the deficit, or using funds from general revenues. Financing through spending cuts (which would most likely be reduced government employment) would be a harder-to-implement, time-consuming process, whereas raising debt and revenues can be done relatively rapidly in the New Zealand political system, which has only a one-house legislature, (often) with a majority government in power.

- ***In the case of deficit financing,*** the government would borrow to finance their expenditures, through its standard mechanisms, and would increase the level of debt permanently.
- ***In the case of funding from general revenues***, the most logical approach would be to increase one or both of the personal income tax (PIT) and the goods and services tax (GST).

12. There are limitations to using model simulations to capture the economic outcomes from closing an exogenously specified infrastructure investment gap. First, most importantly, there is uncertainty as to quantification of the pass-through of infrastructure investment and stock to productivity growth. Second, the caveats associated with ANZIMF are limitations of this analysis, such as the under-responsiveness of trade flows (common to many DSGE models). Third, the methodological concerns for constructing the gap itself can produce misleading results if the gap is quantified incorrectly.[4] Finally, because closing the gap will stimulate the economy, it will also increase GDP which would affect somewhat the demand for infrastructure, changing the investment

[4] These can found in the *Global Infrastructure Outlook*, pp. 179-180. The most interesting concern, conceptually, is that technological innovations over the forecast could fundamentally change the role and provision of infrastructure.

needs, and hence the infrastructure investment gap – a feedback effect that is ignored here, but may not be significant given New Zealand's small gap.

13. Current infrastructure spending by the New Zealand government is still consistent with the forecast of the gap used here. The *Global Infrastructure Outlook* dataset was built contemporaneously with the FY2015/16 budget paths, and tried to capture the trends current at that time, which may have even exceeded the capital allowances stated in the budget. The budgets in FY2016/17 and FY2017/18 increased spending on infrastructure to close the gap for the most part for those two years, and possibly out to FY2020/21, primarily by accounting for stronger-than-expected growth in GDP and population. Therefore, the gap in the short term may be somewhat over-estimated, although other factors also point to some degree of underestimation, as outlined at the end of the previous section.

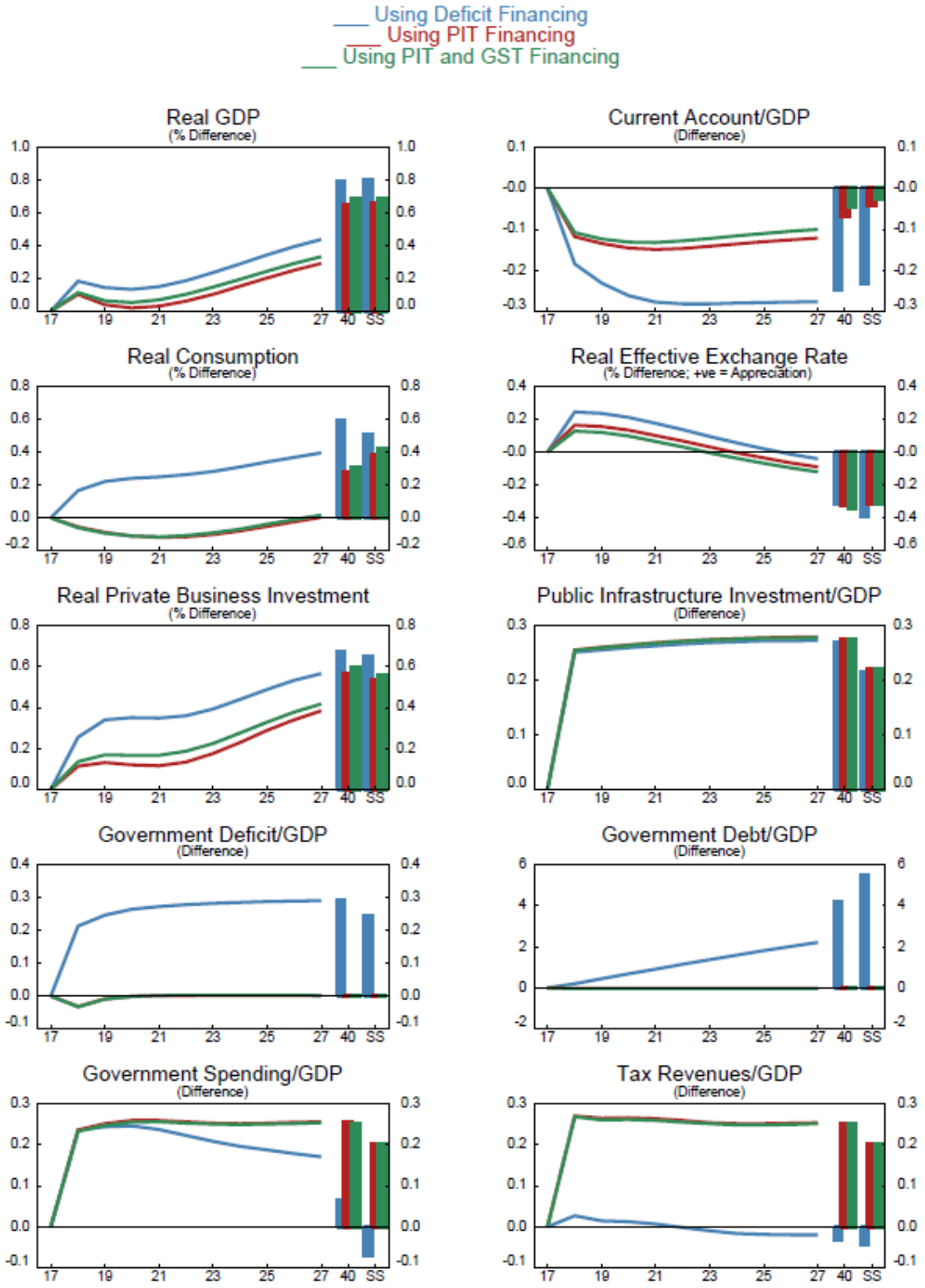
14. Figure 5 illustrates the effects of closing the New Zealand gap. It assumes participation by both the national government and local governments (who derive some financing, but not all, from the national level). The figure shows the first 10 years (using lines) followed by snapshots for the end-point at 2040, and the long-term steady-state result from maintaining the new higher level of the infrastructure capital stock (using vertical bars). There are three variants for financing the closure of the gap: deficit financing by government (blue line and bars); government financing using PIT only (red line and bars); and government financing using both PIT and GST (green line and bars).

15. In the long term, real GDP would be as much as 0.8 percent higher than otherwise, for a long-term multiplier of around 2.7. The small gain reflects that New Zealand's gap is small. With higher productivity, there is a slight long-term depreciation in the real effective exchange rate, allowing for stronger exports. Even though imports cost more, consumption is still between 0.3 to 0.6 percent higher in the long term. A higher infrastructure level means a permanent increase in the level of productivity, passing to the level of labor demand and therefore to wages and labor income, as well as demand for capital and private business investment. Firms would have more income, and would be a source of further wealth to households (their owners) further stimulating consumption. However, there are variations among the three types of financing.

16. Deficit financing would provide the greatest gains. In the short term, deficit financing would be most advantageous, although the government would face a permanent 5.5 percent increase in the government debt to GDP ratio, which would slightly crowd out private business investment, offsetting some of the productivity gain from the additional infrastructure investment. However, the cumulative deficits required out to 2040 are closer to 6.6 percent of GDP, meaning that the additional growth from infrastructure investment reduces the government debt to GDP ratio in the long term by 1.1 percentage points. Deficit financing also increases demand for private saving flows, some of which come from abroad, leading to a worsening of the current account deficit. In the short term, this drives an additional appreciation of the real effective exchange rate, until the economy-wide productivity gains are large enough to lead to a long-term depreciation, relative to the baseline of WEO-consistent forecasts.

Figure 5. Closing the Baseline Infrastructure Investment Gap by 2040

(Deviations from WEO-consistent forecasts)



Note: The bar marked "SS" is the steady-state value.

Source: IMF staff calculations.

17. Financing with PIT and/or GST would be less beneficial and reduce GDP gains. Such taxation would be a drag on consumption, especially during the initial phases of closing the gap, as liquidity-constrained households would adjust their spending downwards immediately. Using PIT financing alone would reduce the gains accruing to the economy the most, as higher PIT not only reduces consumer buying power, it taxes a factor of production directly, and reduces labor productivity, counteracting some of the gains from additional infrastructure investment. Overall, there is less demand for foreign financing – what remains is driven by borrowing for consumption, offset by weaker investment. Therefore, there is less of a short-term appreciation of the real effective exchange rate.

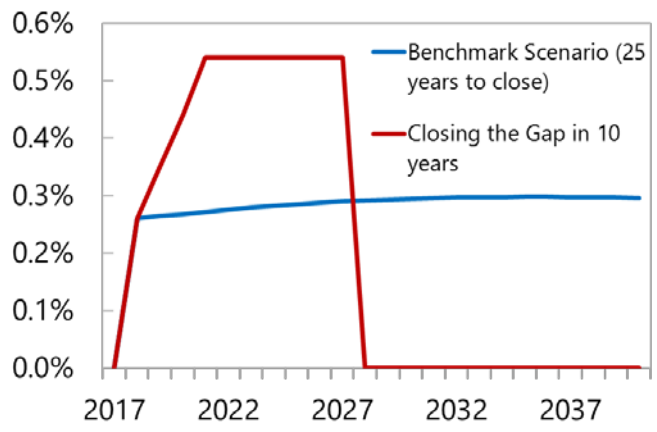
D. Closing the Gap as a Tool for Fiscal Policy

18. Closure of the infrastructure investment gap can be used as tool to further fiscal policy goals. As the government closes its gap, it could alter its focus in one (or more) of three ways for additional benefits: 1) increase the amount of investment in order to reach the desired infrastructure capital stock earlier, allowing New Zealand to maximize its gains sooner; 2) increasing emphasis on spending in regions in greater need of development; and 3) improving the quality of the infrastructure delivered, which could include public-private partnerships (PPPs).

Focus on Closing the Gap Sooner

19. The government could alter the length of time taken to close the gap. Instead of closing the gap over 25 years, the government could choose to help kick-start short-term growth by closing the gap in 10 years, using deficit financing (Figure 6). Although long-term benefits would remain unchanged, doing more than closing the gap would presumably accrue few extra benefits. The government would have to increase their debt load more quickly, and this may pose a risk to credit ratings, and could impose additional sovereign risk premia, although those risks are not quantified here. As moving from under 0.3 percent of GDP to over 0.5 percent of GDP for infrastructure cannot be done easily (because of procurement processes, and selection processes involving cost-benefit analyses), it is assumed to be phased in over four years.

Figure 6. Infrastructure Investment Gaps
(Percent of GDP)



Sources: *Global Infrastructure Outlook*, Oxford Economics, and IMF staff calculations.

20. Figure 7 compares the benchmark scenario (blue line and bars) against the 10-year scenario with deficit financing (red line and bars). The long-term real GDP gains around the

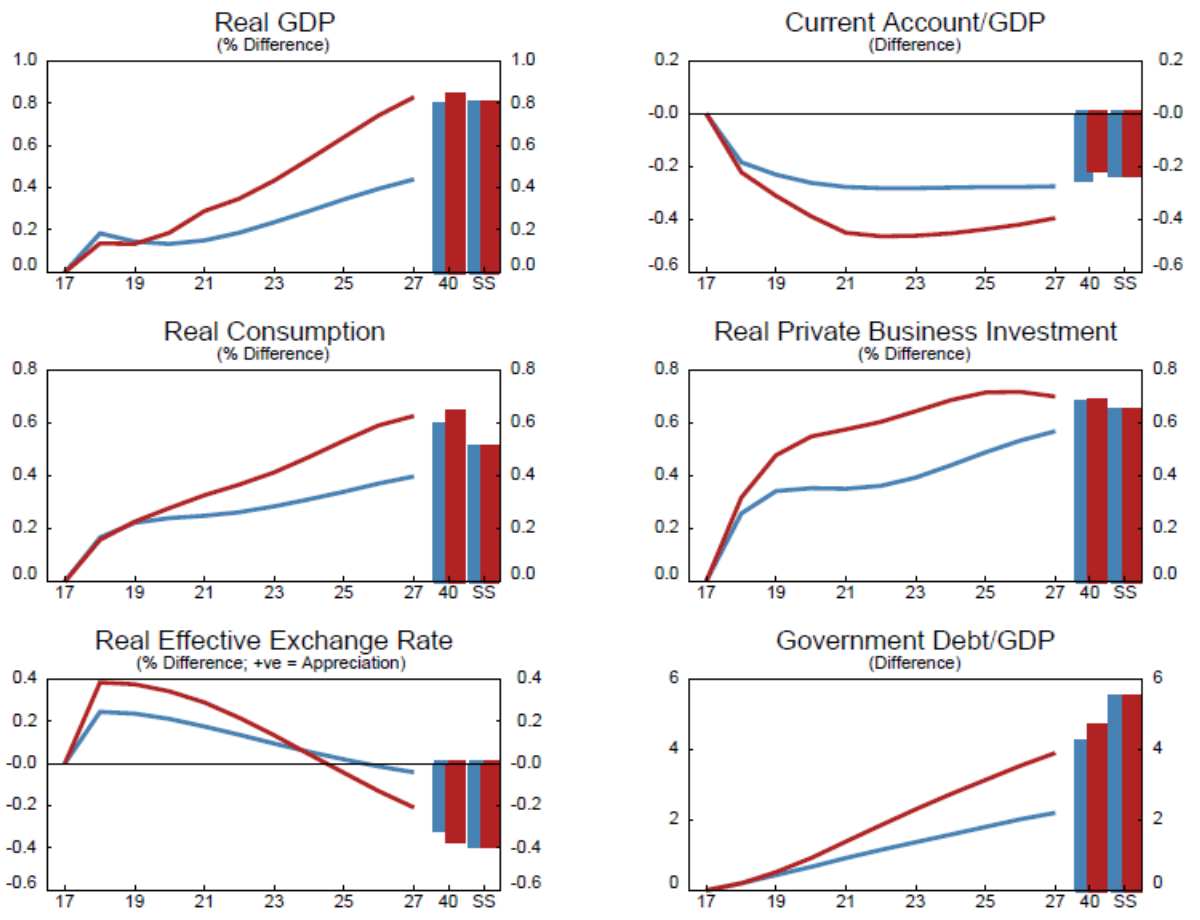
same as in the benchmark scenario, at 0.8 percentage points. But by shortening the time horizon, economic gains are moved forward, and there is much more fiscal stimulus in the short term. Real GDP increases much more rapidly in the short term, adding twice as much to growth over the first 10 years relative the benchmark scenario. Consumption also increases more strongly. However, if the government does it solely through deficit financing, there is greater crowding out of private business investment in the first several years, also leading to crowding out of labor demand and income, and therefore consumption. There is increased demand for foreign financing through the current account, leading to a stronger short-term real effective exchange rate appreciation, although the permanent productivity effects still lead to a long-term depreciation of the real effective exchange rate. Overall, changing the speed at which the gap closes can provide short-term benefits to growth, and fiscal policy can provide a more prominent role in short-term demand management, but with productive spending ensuring long-term gains.

Figure 7. Closing the Gap Earlier

(Deviations from WEO-consistent forecasts)

___ Benchmark Scenario (Deficit Financing)

___ Closing the Gap within Ten Years (Deficit Financing)



Note: The bar marked "SS" is the steady-state value.

Source: IMF staff calculations

21. In practice, changing the horizon for fiscal policy implementation requires careful planning and consideration. It may not be possible to reduce some projects to a shorter horizon and if the economy is already in an expansionary phase, it may be difficult to attract the resources required to carry out the investment. As of 2018, New Zealand has little spare capacity in its labor and capital markets, and might not be able to absorb the needs of a faster expansion of infrastructure investment.

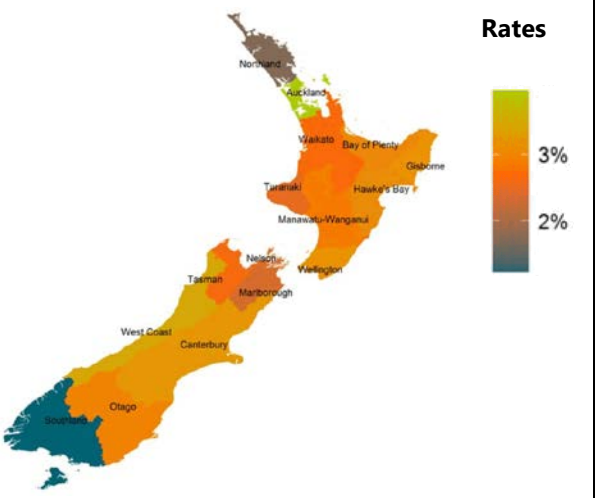
Focus on Furthering Regional Development

22. The government can augment its regional development goals when closing the infrastructure gap. The results so far rest on the assumption that benefits in New Zealand are homogenous, when there may be regional differentiation. By increasing infrastructure investment in regions in need of further development, New Zealand opens up the possibility of greater benefits, not only in terms of the level of real GDP, but also to meet other (social) goals, such as alleviating inequality and poverty.

23. The infrastructure gaps in the *Global Infrastructure Outlook* do not depend on their physical location within New Zealand. Many of the gaps are dependent on location of the population, so placing new infrastructure in the regions can encourage populations to settle elsewhere, in addition to closing the gaps in the regions. Successful redirection of the population would most likely depend on other policies outside of the provision of infrastructure, but that lies outside the scope of this paper, and it is assumed for the discussion that follows that the proper policies are in place.

24. In New Zealand, regions in need of further development generally coincide with poorer regions. These regions are defined in this paper as a subset of New Zealand's 16 local government areas – Northland, Waikato, Bay of Plenty, East Coast (Gisborne), Hawke's Bay, Manawatu-Whanganui, Tasman/Nelson, West Coast, and Southland, which have been the increased focus of regional development efforts in recent years (MBIE, 2017) and often have had low household income growth (Figure 8).

Figure 8. Average Annual Household Income Growth, 2007-2017
(Annual Percent Growth)



Source: MBIE (2017).

25. Regions in need of further development might have a higher output elasticity of public capital than the rest New Zealand, allowing for greater GDP gains than under the benchmark scenario. This is supported by the available literature (Box 3). As an illustrative example, an output elasticity of

Box 3. Choosing the Output Elasticity for the Regions in Need of Development

A revised output elasticity with respect to core infrastructure capital is chosen based on available empirical studies. Recent literature focuses on the United States, Italy and Spain. That of Italy and Spain often look at the regions based on their income disparities, and is more applicable to the New Zealand case. It suggests that regions in need of development can benefit more from increased infrastructure investment.

Literature on Italy focuses on the split between the more industrialized, urbanized North, versus the poorer, more rural South. Bonaglia and others (2000) find that much more of TFP growth in the South than in the North is attributable to public investment. Furthermore, by using a production function approach over 1970 to 1994, they find an output elasticity for the South of about 0.495, versus between 0.1 to 0.2 for the regions of the North. This finding is supported by Marrocu and Paci (2008), using a later sample from 1996 to 2003 under a different production function, with elasticities for core infrastructure of 0.185 for the South, 0.095 for the North, and 0.119 for all of Italy. Percoco (2004) considers the role of efficiency in regional public infrastructure investment, both technical (physical transformation of inputs) and allocative (choosing between factors of production). The frontier for technical efficiency, at 100, is of interest for this paper, and all of Italy falls short by 21 percent, while the South does even worse, by 25 percent.

The literature for Spain focuses more on the individual regions, and has a fuller consideration of the elasticities from infrastructure investment within the region ("inside investment"), and spillovers from investment elsewhere ("outside investment"). Marvão Pereira and Roca-Sagales (2007), using SVARs for Spain and its regions based on data from 1970 to 1995 find an elasticity of 0.523 for core infrastructure. The regions in need of development comprise less than 40 percent of GDP and have elasticities that are 20 to 30 percent higher when combining effects of inside and outside investment. Marquez and others (2011), using an SVAR approach from 1972 to 2000, agree with this finding, but draw a distinction between short- and long-term responses of GDP, finding that private investment benefits from extra public investment in the long term. However, in the short term, there is a tendency for public investment to serve as a substitute for private in these regions, while they act as complements in wealthier regions like Cataluña, reducing the short-term effectiveness for regional development. Finally, Puente (2017), using a production function approach over 1980 to 2015, generally supports the finding that the regions have higher returns to public investment, and have led to better GDP growth per capita. Output elasticities of public capital seem to be about 20 to 30 percent higher for these regions.

For New Zealand, Cochrane and others (2010) concludes that an increase in regional infrastructure spending increases population growth, real income and land values, but is itself endogenous and spatially correlated. While the individual regions are used in their estimation of a four-equation model under 3-stage least squares, there are no estimations for individual regions presented. But the methodology better captures interregional spillovers and demonstrates the positive impact on productivity for New Zealand, which had been in doubt for New Zealand as presented in Kamps (2006) for OECD countries.

Based on this information, the regions in need of development should have an output elasticity somewhere in the range of 20 to 50 percent higher than the rest of New Zealand. Often the elasticities in level terms are notably higher than the modern literature, summarized in Bom and Ligthart (2014), with its output elasticity with respect to core infrastructure of 0.17. For this application, the illustrative output elasticity chosen is 30 percent higher, at 0.221. The effective output elasticity for New Zealand will be a weighted average between that of the regions in need of development and the rest of New Zealand (imputed as a value of 0.152 from the baseline calibration of 0.17 and the GDP share of the rest of New Zealand), where the chosen weights are explained below when presenting each illustrative scenario.

0.221 is used. In the benchmark scenario used so far, with a New-Zealand-wide elasticity of 0.170 (as found in Bom and Ligthart, 2014), it is assumed that infrastructure investment is distributed by the regions' share of total GDP. Given that these regions account for 26.0 percent of total GDP on average from 2012 to 2016, the implied elasticity for the rest of New Zealand is 0.152. On a per capita basis, there has been underinvestment in the regions in need of development, thereby redistributing the stock of infrastructure over time to the rest of New Zealand. Five additional cases are considered:

- ***Weight the distribution of infrastructure based on the average population from 2012 to 2016***, so that these regions receive 32.6 percent of the total investment, implying a New Zealand-wide output elasticity of public capital of 0.175. Using population as a basis is more likely to maintain the current ratio of infrastructure between these regions and the rest of New Zealand.

- ***Repeat the population-weighted distribution of infrastructure investment, but with an additional efficiency assumption***, using Italy as an analogous case (from Percoco, 2004, outlined in Box 3), that overall efficiency is 5 percent lower in these regions.

- ***Repeat both scenarios, but augment the population weight for the regions in need of development*** by 25 percent so that these regions receive 40.8 percent of infrastructure investment, lifting the output elasticity to 0.180.

- ***An illustrative scenario where the infrastructure gap is solely closed through investment in these regions***, to demonstrate the upper bounds of the possible gains, but ignoring the obvious point that the rest of New Zealand does indeed face some infrastructure gaps that need to be addressed.

26. Devoting more resources to regional development will augment the outcome. It will make more of a difference for those regions in need of further development, but not so much at the aggregate level. Table 1 shows the long-term outcomes on real GDP for the five scenarios. There are small gains for New Zealand, usually less than 0.1 percent of GDP in the long term. However, this is only from a shift of spending from the rest of New Zealand of 6.6 percentage points of spending when using the population share, or almost 8.3 percentage points using the augmented share. Most of the gain should accrue to the regions in

Table 1. Closing the Infrastructure Investment Gap for Regional Development
(Deviations from WEO-consistent forecasts)

	Aggregate Output Elasticity	Aggregate Real GDP Full Effect	Aggregate Real GDP Lower 1/	Regional Real GDP Full Effect
Benchmark	0.170	0.80	…	0.21
Population Share	0.175	0.82	0.81	0.23
Population Share Plus 25 Percent	0.180	0.84	0.83	0.25
Illustrative "Regions Only"	0.221	0.98	…	…

1/ "Lower" means that technical efficiency is 5 percent lower in the regions in need of development relative to the rest of the country.
Source: IMF staff calculations

need of development – their spillovers to the major urban areas are slight; instead the regions are usually subject to spillovers from the major urban areas (taking Marquez and others, 2011, as an indication). If the benchmark gains are attributed to these regions based on their GDP share, then they receive 0.21 percentage points of the increase in GDP. This will increase to 0.25 percentage points under the scenario based on the augmented population weights.

Focus on Improving the Quality of Infrastructure Investment

27. Another way in which the return to infrastructure investment can be augmented is by improving the quality of the infrastructure. While New Zealand generally produces high quality infrastructure for the funds it spends, it is not the leader among the high-income group; rather it is Singapore, as seen by the quality scores presented in Table 2 from *The Global Competitiveness Report* (World Economic Forum, 2017). In this case, "quality" can be thought of as some combination of more efficient use of funds and better technology, which is a similar but less technical definition than those for allocative and technical efficiency discussed in the previous section.

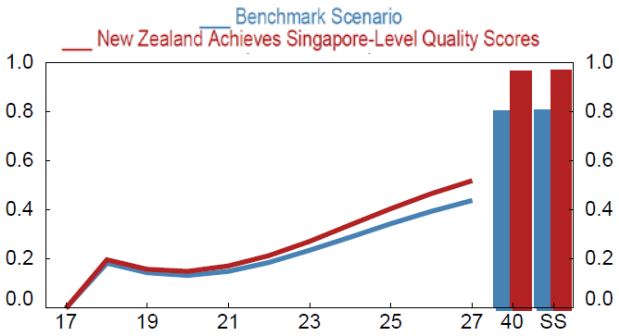
28. Applying a "conversion factor" would bring the quality of New Zealand infrastructure to the same level as Singapore, based on their quality scores. The conversion factor is the weighted sum of the ratio of Singapore quality score to that of New Zealand equivalent for each of the five sectors (energy, airports, ports, rail, and roads), where the weights are based on the average share of each sector in New Zealand's infrastructure capital stock. It is assumed that the conversion factor is also valid for the water and telecommunications sectors. The aggregate conversion factor of 1.23 is then applied to the benchmark rate of pass-through of new infrastructure capital into New Zealand's productivity.

Table 2. Infrastructure Quality Scores
(Range of 1 to 7; 7 is best)

	New Zealand	Singapore
Energy	6.5	6.9
Airports	5.6	6.9
Ports	5.5	6.7
Rail	3.5	5.9
Roads	4.7	6.3

Source: *Global Competitiveness Report, 2017-18.*

Figure 9. Matching Infrastructure Quality in Terms of Real GDP
(Deviations from WEO-consistent forecasts)



Note: The bar marked "SS" is the steady-state value.
Sources: *Global Infrastructure Outlook*, Oxford Economics; and IMF staff calculations.

29. Figure 9 presents the outcomes for New Zealand if its new infrastructure had the same quality as in Singapore. The blue line and bars are the benchmark scenario, while the scenario with

improved quality is the red line and bars. The infrastructure investment gap is unchanged, as is the spending is required to close it. For ease of comparison, only the case of deficit financing is considered. However, the differences between the two scenarios are very similar under the variants for financing the gap using PIT or PIT and GST.

30. The scenario demonstrates that New Zealand could experience further gains by improving their quality scores. If the quality of the newly-built infrastructure was at levels achieved in Singapore, real GDP would be almost 0.2 percentage points above the gains in the benchmark scenario, so that closing the infrastructure gap would results in a 1.0 percent gain in the long term. Most of the effects on the economy are the qualitatively the same as the benchmark scenario, but quantitatively amplified. However, improved quality does not directly incur additional government spending, thereby avoiding any additional government debt.

31. The government could help realize these gains by relying more on PPPs. New Zealand already has a PPP framework in place. Its goal is not to move funding needs off the government books; rather, the main expected benefits are greater efficiency gains from using private sector expertise and knowledge when building new infrastructure (Treasury, 2015). Risks are supposed to be mitigated and allocated between the public and private sectors through the agreements put in place to govern the process, as suggested in the literature (Corbacho and Schwartz, 2008).

E. Conclusions

32. Summary. There has been high quality work done to quantify the infrastructure gap for New Zealand by Oxford Economics on behalf of the Global Infrastructure Hub, drawing on international experiences and local data sources, but recognizing the risk that the infrastructure gap may be even larger than that stated in this work. This paper provides further analysis about the effects on New Zealand's economy of closing the infrastructure gap. Closing the gap has quantifiable benefits, not just because it is a short-term stimulus to aggregate demand, but because of longer-lived effects on productivity, benefiting all sectors of the economy.

33. The form of financing for the additional spending matters. While there are economic gains in all cases, the magnitude of those gains depends on whether the spending relies on deficit or tax financing. In the long term, because of the small amounts required to finance the expenditure, financing by deficits are preferable to tax financing. However, deficit financing has its risks. If the infrastructure needs were much greater, the level of debt incurred would be costlier in the long term, and could outweigh the productivity gains in the economy by crowding out too much investment, and possibly lead to an additional sovereign risk premium on New Zealand's borrowing from abroad.

34. Closure of the gap can be used to further fiscal policy objectives. By changing or augmenting its focus, the government could provide even more benefits. Three examples on which the government could focus are:

- ***Shortening the time horizon*** over which it works to close the infrastructure investment gap to achieve the same level of infrastructure stock in the long term. Consequently, the government could provide additional short-term stimulus to the economy.

- ***Furthering regional development.*** Evidence from other countries suggest that regions in need of development have a higher output elasticity with respect to infrastructure capital. Therefore, New Zealand could increase their returns to infrastructure investment by ensuring that closing the infrastructure gap does not just build on patterns that favor the major urban areas, but pushes more to its regions in need of further development. However, the success of such a strategy would depend on other policies to encourage the utilization of that infrastructure where it is installed, primarily by encouraging the relocation of firms and households.

- ***Improving the quality of infrastructure investment.*** An illustrative example is presented where New Zealand has Singapore-level quality scores. This could be at least partially achieved by using the existing PPP framework.

35. There are prospective gains from closing New Zealand's infrastructure gap. New Zealand has improved its infrastructure spending in the past several years. Nonetheless, there is scope to expand it further, to reduce its (admittedly small, but probably understated) infrastructure gap to match other advanced economies, and possibly help with regional development concerns.

References

Abiad, A., D. Furceri, and P. Topalova, 2016, "The Macroeconomic Effects of Public Investment: Evidence from Advanced Economies," *Journal of Macroeconomics* 50: 224-240.

Anderson, D., B. Hunt, M. Kortelainen, M. Kumhof, D. Laxton, D. Muir, S. Mursula, and S. Snudden, 2013, "Getting to Know GIMF: The Simulation Properties of the Global Integrated Monetary and Fiscal Model," International Monetary Fund, IMF Working Paper 13/55.

Aschauer, D., 1989, "Is Public Expenditure Productive?" *Journal of Monetary Economics* 23(2): 177-200.

Bernanke, B., M. Gertler and S. Gilchrist, 1999, "The Financial Accelerator in a Quantitative Business Cycle Framework," in J. Taylor and M. Woodford, eds., *Handbook of Macroeconomics, Volume 1c*, Amsterdam: Elsevier.

Blanchard, O., 1985, "Debts, Deficits and Finite Horizons," *Journal of Political Economy* 93(2): 223-47.

Bom, P., and J. Ligthart, 2014, "What Have We Learned from Three Decades of Research on the Productivity of Public Capital?" *Journal of Economic Surveys* 28(5): 889-916.

Bonaglia, F., E. La Ferrara, and M. Marcellino, 2000, "Public Capital and Economic Performance: Evidence from Italy," *Giornale degli Economisti e Annali di Economia* 59(2): 221-44.

Cochrane, W., A. Grimes, P. McCann and J. Poot, 2010, "The Spatial Impact of Local Infrastructural Investment in New Zealand," Motu Economic and Public Policy Research Working Paper No. 10-12.

Controller and Auditor-General, 2017, *Local Government: Results of the 2015/16 Audits*, Wellington, New Zealand: Controller and Auditor-General, retrieved at https://www.oag.govt.nz/2017/local-govt/docs/local-govt.pdf.

Corbacho A., and G. Schwartz, 2008, "PPPs and Fiscal Risks: Should Governments Worry?" in G. Schwartz, A. Corbacho and K. Funke (eds.), *Public-Private Partnerships: Addressing Infrastructure Challenges and Managing Fiscal Risks*, New York: Palgrave Macmillan.

International Monetary Fund, 2018, *World Economic Outlook, April 2018*, Washington, D.C.: International Monetary Fund.

Kamps, C., 2006, "New Estimates of Government Net Capital Stocks for 22 OECD Countries, 1960-2001," *IMF Staff Papers* 53(1): 120-150.

Kumhof, M., D. Laxton, D. Muir, and S. Mursula, 2010, "The Global Integrated Monetary and Fiscal Model (GIMF) – Theoretical Structure" International Monetary Fund, IMF Working Paper 10/34.

Marrocu, E. and R. Paci, 2008, "The Effects of Public Capital on the Productivity of the Italian Regions," *Applied Economics* 2008: 1-14.

Marquez, M., J. Ramajo, and G. Hewings, 2011, "Public Capital and Regional Economic Growth: a SVAR Approach for the Spanish Regions," *Investigaciones Regionales* 21: 199-223.

Marvão Pereira, A., and O. Roca-Sagales, 2007, "Public Infrastructure and Regional Asymmetries in Spain," *Revue d'Économie Régionale et Urbaine* 2007(3): 503-519.

Ministry of Business, Innovation and Employment (MBIE), 2017, "Briefing for the Incoming Minister for Regional Development," Wellington, New Zealand: Government of New Zealand, retrieved at http://www.beehive.govt.nz/sites/default/files/2017-12/Regional%20Economic%20Development.pdf.

Oxford Economics and Global Infrastructure Hub, 2017, *Global Infrastructure Outlook: Infrastructure Investment Needs, 50 Countries, 8 Sectors to 2040*, July, 2017, Sydney: Global Infrastructure Hub.

Percoco, M., 2004, "Infrastructure and Economic Efficiency in Italian Regions," *Networks and Spatial Economics* 4: 361-378.

Puente, S., 2017, "Regional Convergence in Spain: 1980-2015," Banco de España, *Economic Bulletin* 3/2017: 1-6.

Treasury, 2015, *Public Private Partnership Programme – The New Zealand PPP Model and Policy: Setting the Scene; A Guide for Public Sector Entities*, Wellington, New Zealand: Treasury, retrieved at https://treasury.govt.nz/sites/default/files/2015-10/ppp-public-model-and-policy-sep15.pdf.

Weil, P., 1987, "Permanent Budget Deficits and Inflation," *Journal of Monetary Economics* 20(2): 393-410.

World Economic Forum, 2015, *The Global Competitiveness Report, 2014-2015*, Geneva: Global Competitiveness and Benchmarking Network.

_____, 2017, *The Global Competitiveness Report, 2017-2018*, Geneva: Global Competitiveness and Benchmarking Network.

Yaari, M., 1965, "Uncertain Lifetime, Life Insurance, and the Theory of the Consumer," *Review of Economic Studies* 32(2): 137-50.

REVAMPING INFLATION TARGETING IN NEW ZEALAND 30 YEARS AFTER ITS INCEPTION[1]

A. Introduction

1. Almost 30 years after establishing the first inflation targeting regime, New Zealand has embarked on a review of the Reserve Bank Act. The government initiated the review in late 2017. The review process consists of two phases. Phase One deals with the monetary policy framework and the related decision-making, while Phase Two will review the financial and other policies of the Reserve Bank of New Zealand (RBNZ). In the first phase, an Independent Expert Advisory Panel was formed to recommend changes to the Act to (i) ensure that monetary policy decision-makers give due consideration to maximizing employment alongside price stability; (ii) provide for a committee approach for monetary policy decisions; and (iii) consider whether changes are required to the role of the RBNZ Board of Directors. Terms of reference for Phase Two, which is expected to start in the second half of 2018, will be issued soon, after the Independent Expert Advisory Panel has made its recommendations for the scope of the review.

2. Cabinet decisions on changes to the Reserve Bank Act following Phase One recommendations are now awaiting legislation. After considering the Panel's recommendations[2] the Cabinet decided on the way forward, agreeing to add an employment objective to the price stability objective and to delegate monetary policy decision-making to a monetary policy committee (MPC).[3] The RBNZ Board of Directors will be responsible for monitoring performance of the MPC and its individual members in their duties. The review also highlighted that the desired outcome is for decision making to be less governor-centric and a Monetary Policy Committee will be formed. These modifications will be captured formally in an amending bill to the Reserve Bank Act in the coming months.[4]

3. Overall, Phase One of the review has not led to fundamental changes to the monetary policy regime and is unlikely to result in changes in monetary policy conduct. The RBNZ will continue to operate its successful flexible inflation targeting regime. As argued below, the latter has already involved *de facto* output and employment stabilization. While the decision-making model will change, the operational independence of the RBNZ has only been affected at the margin. Monetary policy making remains a delegated policy mandate. The new *Policy Targets Agreement* (PTA) signed on 26 March ahead of a new Governor taking office already incorporates an employment objective along the traditional price stability objective (RBNZ, 2018a). The RBNZ is thus

[1] Prepared by Zoltan Jakab (RES). The chapter benefited from valuable comments after a presentation at the RBNZ.

[2] See Independent Expert Advisory Panel (2018).

[3] See Cabinet Paper (2018).

[4] See RBNZ (2018a).

operating under a dual mandate, similar to the Reserve Bank of Australia (RBA) and the U.S. Federal Reserve System (Fed).

4. This paper reviews the backdrop to the revamping of the inflation targeting framework in New Zealand. Section B reviews the recent experience with the flexible inflation targeting regime, highlighting that the regime has been successful both in stabilizing inflation and keeping it low and in avoiding large output fluctuations. Still, the relatively long recent episode of inflation being below target highlights the risk of a rigid employment objective, as uncertainty about the extent of slack in overall economy or in the labor market can be sizeable. Section C reviews the main aspects that the dual mandate framework will require for the operationalization of monetary policy. Section D concludes.

B. Evolution and Performance of Inflation Targeting in New Zealand

From Strict to Flexible Inflation Targeting

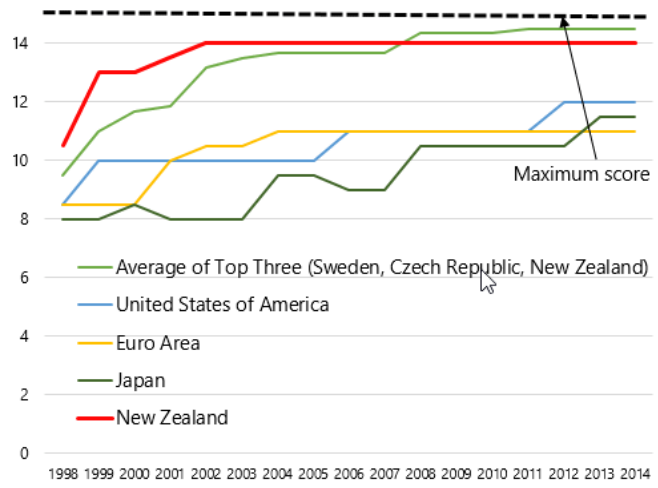
5. The practice of inflation targeting in New Zealand has evolved over the time. New Zealand was the first country to adopt Inflation Targeting (IT) in 1989. The specifics of the objectives and the operationalization of inflation targeting have changed considerably over time even though the overarching objective of price stability and other features of inflation targeting put in place in the 1989 Revision of the Reserve Bank Act have not changed. Most noticeably, the regime evolved from a strict inflation targeting regime to a more flexible inflation targeting regime (McDermott, 2018).

6. Following McDermott (2018), there have been three periods in the evolution from strict to more flexible inflation targeting. In the first period, the period of strict inflation targeting, the focus was on achieving inflation such that annual inflation was to remain inside the target band, and the RBNZ had to explain deviations resulting from shocks outside of the RBNZ's control. There were no secondary considerations specified in the PTAs. In the second period, from the late 1990s to the end of the 2000s, inflation targeting became increasingly flexible. Flexibility refers to the fact that the time to achieve the target was implicitly lengthened, while the shocks listed in the PTAs that could result in permissible deviations of actual inflation from target became more illustrative rather than exhaustive. As of 2002, the inflation objective was to be achieved over the medium term, rather than on an annual basis. Also, since 1999, so-called secondary considerations were established in PTAs. The RBNZ was set to seek to avoid unnecessary instability in output, interest rate and exchange rates. Finally, in the third period, this decade, PTAs clarified that the focus was on the 2 percent midpoint of the target range, while other secondary considerations were added to the framework (asset prices, financial stability).

7. In the transition from strict to flexible inflation targeting, the RBNZ has remained a leader in the implementation of inflation targeting. In particular, the RBNZ increasingly used the inflation forecast as the intermediate monetary policy objective. In the current inflation targeting literature, the term "inflation forecast targeting" (IFT) is often used synonymously with flexible

inflation targeting.[5] In this framework, the central bank communicates on how it will achieve the inflation objective through its forecasts and the monetary policy setting embedded in the forecast. Such a regime requires a high degree of policy transparency, which the RBNZ has maintained over time, as measured, for example, by the Dincer-Eichengreen index (Figure 1). In particular, since 1997, the RBNZ has been fully disclosing its macroeconomic forecast, including the expected path of the policy rate (Table 1).

Figure 1. Dincer-Eichengreen Central Bank Transparency Index



Source: Dincer and Eichengreen (2014) and IMF staff calculations.

8. The evolution of inflation targeting in New Zealand took place in the context of a broader evolution of global IT practice. In the early stages, the RBNZ, like other IT central banks, focused primarily if not exclusively on achieving price stability objectives. The lack of concern about output and employment stability was based on the argument that, in most situations, "divine coincidence" was present (monetary policy aimed at stabilizing inflation happens to also stabilize output).[6] But, over time, experience suggested that paying little or no attention to output or employment was not optimal in all situations. Depending on the nature of the shocks affecting the economy, monetary policy paying attention to output stabilization might actually help in achieving price stability objectives in the longer term.[7] Important examples are the case of large shocks generating a trade-off between stabilizing inflation and resource utilization, or when policy tries to ensure a low probability of hitting the zero lower bound on interest rates.[8] Clinton and others (2015) argue that central banks following flexible inflation targeting frameworks also operate with a dual mandate, albeit the second (output or employment) objectives are sometimes not explicitly formulated.

[5] IFT is defined in Adrian and others (2018), among others. This paper uses the terms "flexible inflation targeting" and IFT interchangeably. In this regime, the forecast is the intermediate target; the inflation objective is the ultimate anchor. Moreover, the central bank's inflation forecast is the intermediate target: it is used to communicate how the central bank is managing the short-term output-inflation tradeoff (explicit or implicit dual-mandate) and it is based on all available information and views about how the economy works. In a flexible inflation targeting regime the emphasis is on uncertainty and "avoiding dark corners" (a prudent risk-management approach to policy formulation and communications).

[6] Among others, Rogoff (1985) and Walsh (1995) argue for a strong focus on price stability. Woodford (2003) argued that a welfare-maximizing central bank should assign some, albeit a relatively small, weight to output stabilization when forming policy. Blanchard and Galí (2007) showed that stabilizing inflation allows the central bank to simultaneously stabilize welfare-relevant measures of economic activity, which is also known as the "divine coincidence."

[7] For example, see Debortoli and others (2017).

[8] For similar arguments, see Clinton and others (2015).

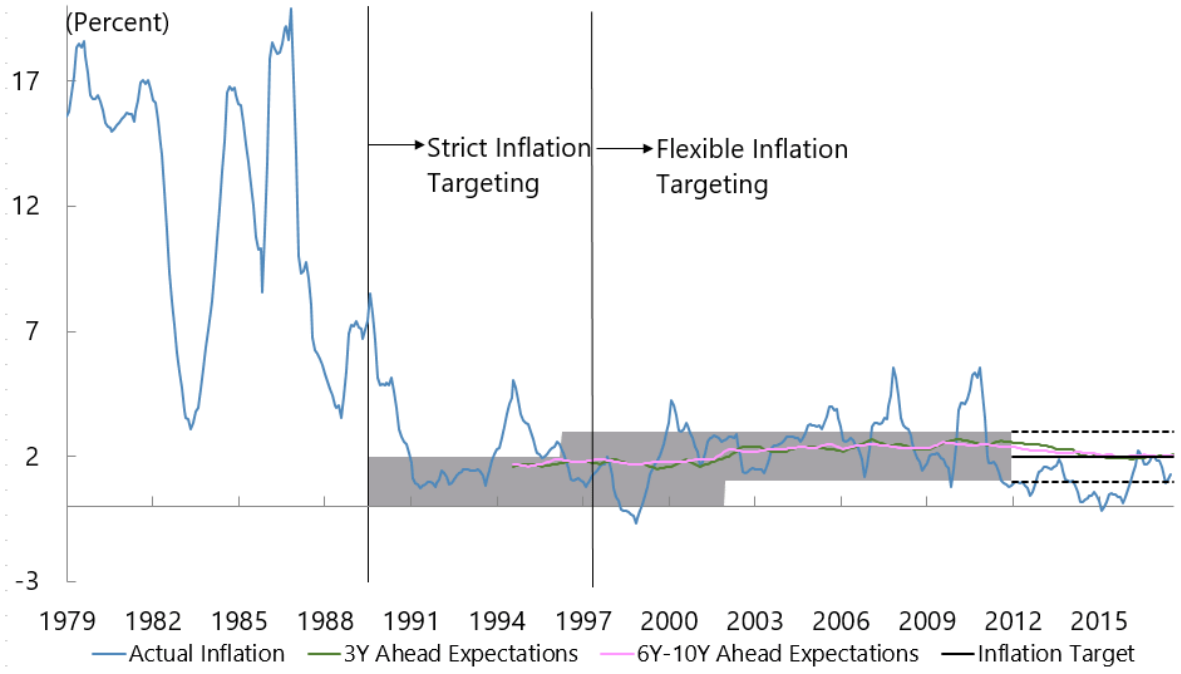
Table 1. Established IFT Central Banks Endogenous Interest Rate Forecasts	
Canada	No, but communicate it with words
Chile	No, but communicate it with words
Czech Republic	Yes (since 2008)
New Zealand	Yes (since 1997)
Norway	Yes (since 2005)
Sweden	Yes (since 2007)
United States	Yes (since 2012)

Source: Clinton and others (2017).

Inflation Targeting and Economic Outcomes in New Zealand

9. Comparing outcomes between the strict and flexible inflation targeting regimes, both inflation and output are now more stable. Figure 2 shows that inflation expectations, both in the short and long term, were well-anchored quickly in the first period of inflation targeting in New Zealand (under "strict inflation targeting"). Both the level and the variability of inflation were also lower than before. But key real variables, output and employment, experienced increased volatility (Table 2). With the transition to flexible inflation targeting, low inflation, both level and variability, could be maintained, while the variability of GDP growth and employment also became more stable (and the variance of the output gap remained the same). The nominal exchange rate also served as a shock-absorber since 2002. In the case of well-functioning flexible inflation targeting, the nominal exchange rate plays a significant stabilization role, especially for small open economies facing significant commodity price shocks.

Figure 2. Inflation and Expected Inflation



Sources: Haver Analytics, and International Monetary Fund.

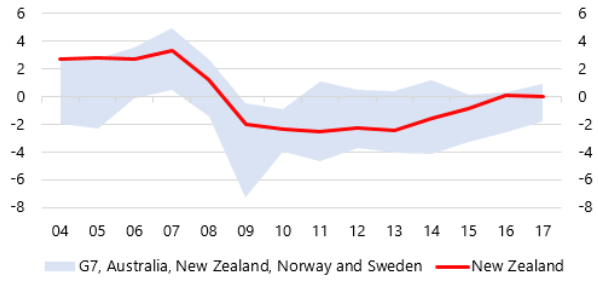
Table 2. Macroeconomic Performance Under Different Monetary Regimes (1981-2017)

	GDP growth (annual % change)	Output gap* (% of potential GDP)	CPI inflation (annual % change)	Unemployment rate (%)
Average				
Before Inflation Targeting (1981-1989)	2.4	-0.8	11.3	5.4
Strict Inflation Targeting (1990-1997)	2.8	-1.8	2.5	8.4
Flexible Inflation Targeting (1998-2017)	2.9	-0.2	2.0	5.3
Standard error				
Before Inflation Targeting (1981-1989)	1.5	1.3	4.7	1.5
Strict Inflation Targeting (1990-1997)	2.8	2.0	1.7	1.8
Flexible Inflation Targeting (1998-2017)	1.5	2.0	1.1	1.1

Source: Haver Analytics, International Monetary Fund Spring 2018 World Economic Outlook.

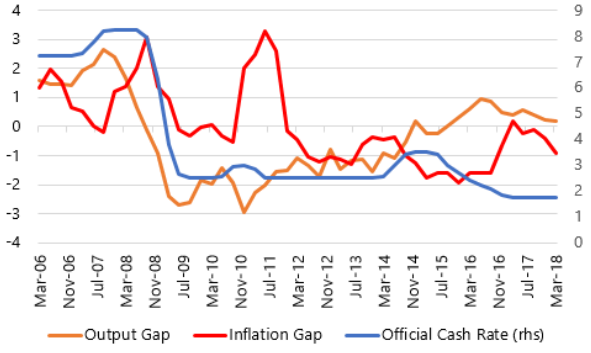
10. New Zealand experienced mild output losses during the Global Financial Crisis (GFC). Although the recovery after the GFC took longer than after other recessions, New Zealand's output loss was less severe than that in many other advanced economies (Figure 3). Part of the reason was that well-anchored inflation expectations helped keep the ex-ante real interest rates low during the height of the crisis and monetary easing thus helped to stabilize output. The Official Cash Rate (OCR) did not reach its effective lower bound (Figure 4). The trough of the output gap after the GFC was among the closest to zero in New Zealand, such that the mean output gap was less negative compared to the euro area, Japan, and United States, for example (Table 3). While monetary policy contributed to this favorable outcome, other factors also contributed, including strong aggregate demand support from Asia, positive supply shocks (an acceleration of net migration filling in higher skilled jobs), the fact that New Zealand did not experience direct shocks to its financial system or trade financing, and favorable commodity price developments.

Figure 3. Output Gap in Selected Economies
(Percentage of potential GDP)



Source: International Monetary Fund, Spring 2018 World Economic Outlook.

Figure 4. Official Cash Rate and Inflation* and Output Gap
(Percentage point)



* Inflation Gap as measured by deviation from the 2 percent target.
Source: Reserve Bank of New Zealand, Monetary Policy Statement, May 2018.

Table 3. Descriptive Statistics on Output Gaps (2009-2017)

	Average	Standard Error	Minimum	Maximum
New Zealand	**-1.5**	**1.0**	**-2.5**	**0.1**
Australia	-0.8	0.3	-1.1	-0.1
Canada	-0.4	1.3	-3.1	1.2
Euro Area	-1.7	0.8	-2.8	-0.5
France	-2.1	0.5	-2.8	-1.1
Germany	-0.3	1.5	-3.9	1.1
Italy	-2.6	1.3	-4.1	-0.5
Japan	-3.2	1.9	-7.3	-0.8
Norway	-0.7	0.6	-1.3	0.2
Sweden	-1.3	1.7	-4.8	0.7
UK	-1.5	1.1	-3.0	-0.1
US	-1.8	1.7	-4.6	0.3

Source: International Monetary Fund, Spring 2018 World Economic Outlook, IMF staff estimates.

11. Recently, the main monetary policy challenge has been to deal with inflation being below its target in an economy close to or at full employment. As many other countries, New Zealand has, since the GFC, experienced a relatively long period of inflation remaining below its target, the mid-point of the 1-3 percent target range. In part, the undershooting has been the result of imported deflation, with tradable price deflation reflecting a long and weak global recovery after the global financial crisis. Domestically, positive labor supply shocks from net migration inflows contributed to high employment growth and larger than expected increases in potential output.[9] As a result, economic slack decreased more slowly than expected by the RBNZ. Inflation, therefore, remained weaker than expected. Moreover, in the absence of a domestic policy rate response, the decline in equilibrium real interest rates worldwide (see Laubach and Williams, 2015 and Obstfeld and others, 2016) would have also contributed to the tighter monetary conditions. Over time, however, estimates of output gaps were revised, taking into account the persistent labor supply and tradable deflation dynamics. Policy rates were lowered and the RBNZ has signaled the need for monetary policy to remain accommodative for a considerable period of time.

C. Operationalization of the Dual Mandate

12. Despite the growing recognition that using monetary policy for stabilization is beneficial, only two central banks have explicit dual mandates.[10] The two central banks with a

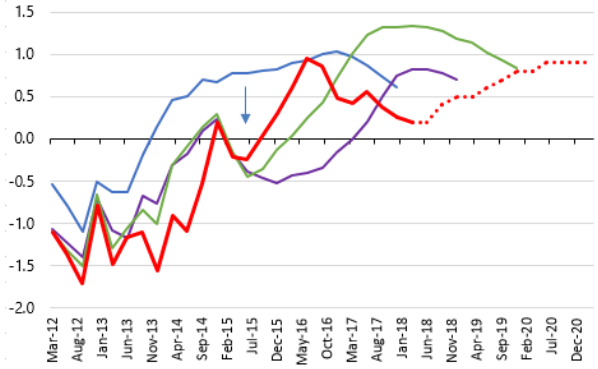
[9] In addition, considering the very dynamic increase in house prices, monetary policy might have been reluctant to ease further to safeguard financial stability. In other words, monetary policy, despite not being at the effective lower bound, was in a situation where the risk of potential negative outcomes from further easing was deemed to be significant.

[10] Following U.S. practice, a joint price stability and employment mandate is often referred to as dual mandate. For an overview of central bank mandates, see Reis (2013).

Figure 5. Revisions to the Projections in the Monetary Policy Statements

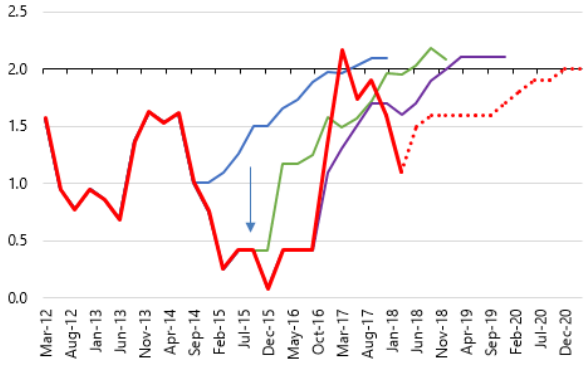
Positive output gaps were revised down.

Output gap (%)



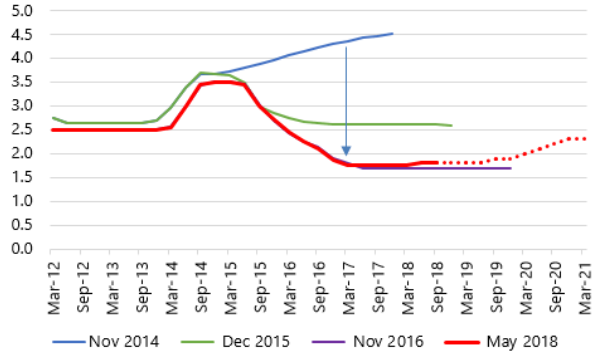
Inflation was systematically below target.

Headline inflation



Interest rate path was revised down.

Official Cash Rate



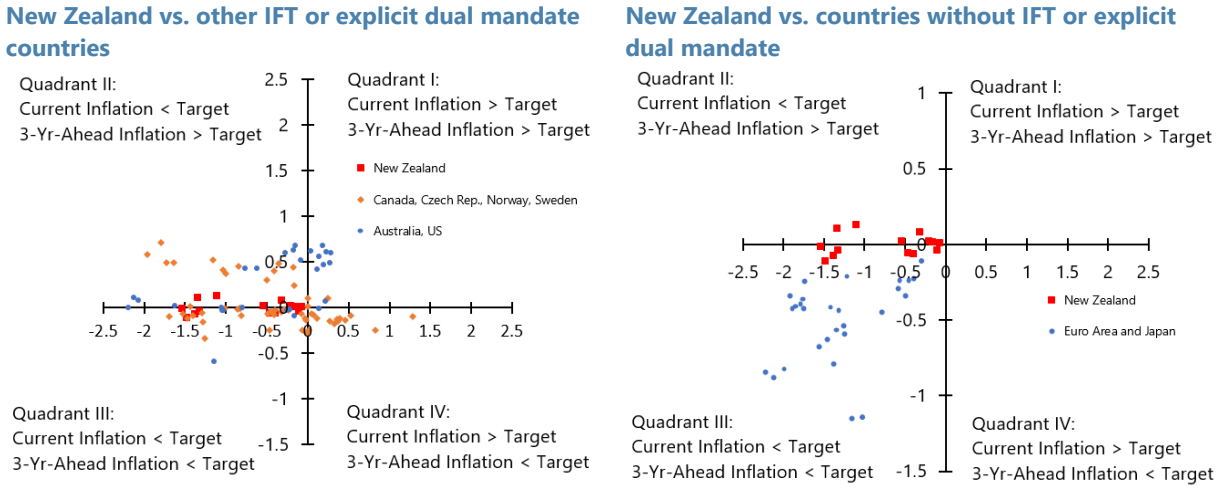
Source: RBNZ, Monetary Policy Statement, May 2018.

(legally) explicit dual-mandate central banks are the Fed in the United States and the Reserve Bank of Australia.

13. In practice, monetary policy outcomes in countries with flexible inflation targeting are similar, irrespective of whether the dual mandate is implicit or explicit. Flexible inflation targeting countries (including New Zealand) have enjoyed policy and welfare outcomes that were similar to those in countries where the central bank has an explicit dual mandate. The behavior of two key indicators, inflation and output gap, suggests that there appears to be slight difference in outcomes among flexible inflation targeting countries, regardless of whether the secondary objective is implicit or explicit. Figures 6 and 7 illustrate this point. Figure 6 shows that if current inflation was below the target, expected inflation was higher than or at the target (a slight overshooting 3 year ahead) in the countries with an explicit dual mandate and in the countries with a flexible inflation targeting regime. On the other hand, in countries that do not follow a flexible inflation targeting regime or that do not have an explicit dual mandate (e.g., the euro area or Japan), expectations were drifting. In this case, when economic slack was present and when current inflation

was low, lower expected future inflation drove up real interest rates and induced an immediate real appreciation in the currency. This further depressed output and lowered inflation in the future. In flexible-inflation-targeting countries and explicit dual mandate countries this was not the case. Markets expected that monetary policy would try to recover some of the output loss associated with lower-than-target inflation, and inflation expectations remained stable. Figure 7 presents the loss arising from a hypothetical welfare measure (with equal weight on the output gap and inflation 's deviation from its target).[11] By this metric, New Zealand fared quite well in international comparison as both inflation and output were stabilized to a considerable extent since 2012. Japan and the euro area, both of which do not belong to the group of flexible-inflation-targeting countries had a worse overall outcome than most flexible-inflation-targeting countries.

Figure 6. Anchoring of Inflation Expectations (2015-2018)



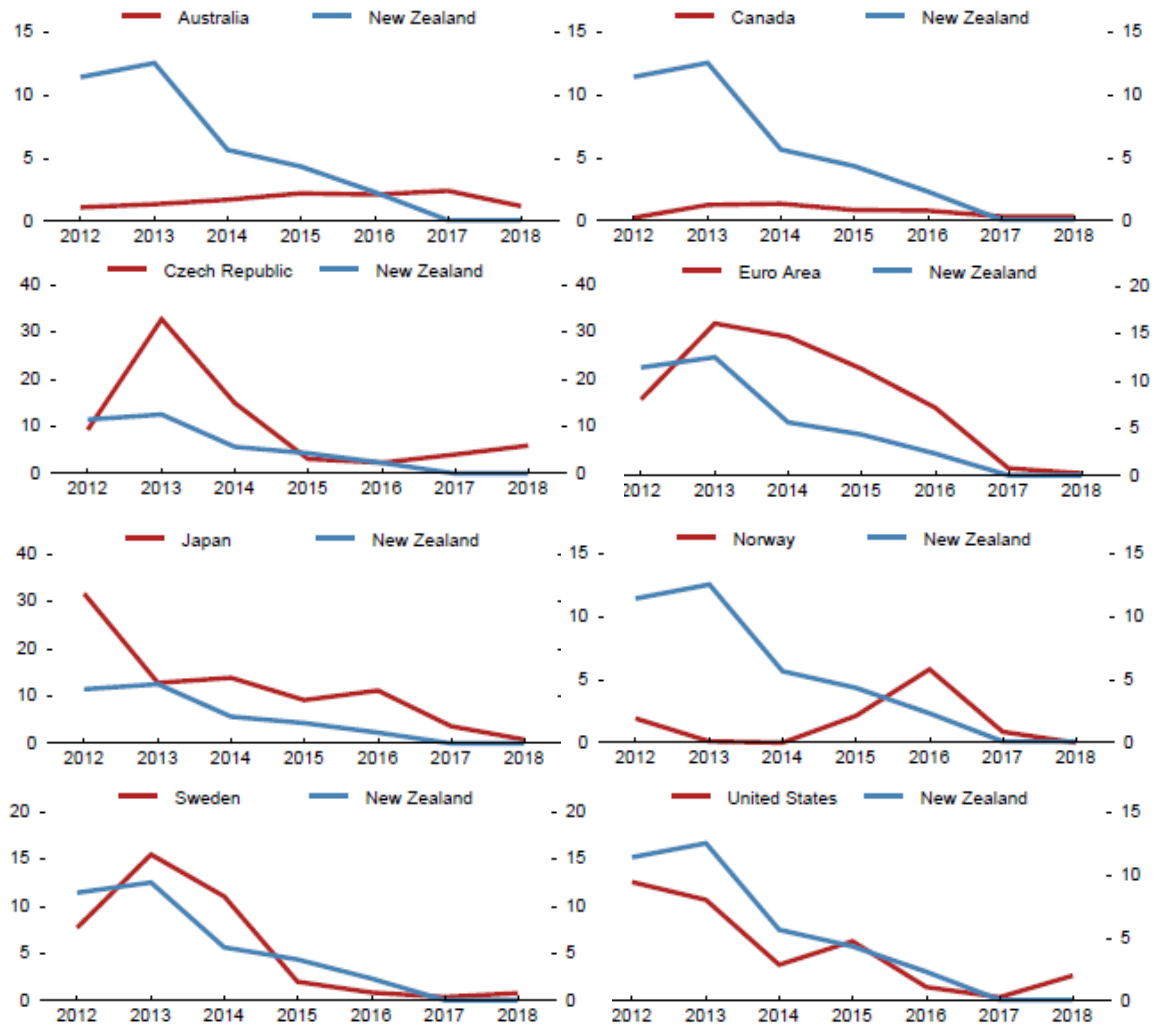
Source: Consensus Economics, IMF staff estimates.

14. A numerical employment objective could unduly constrain the conduct of monetary policy, constraining and straining the RBNZ's credibility. The behavior of inflation expectations and the welfare losses in New Zealand (Figures 6 and 7) are consistent with the claims of McDermott (2018) that, after the late 1990s, the RBNZ became flexible and secondary considerations were added (avoiding unnecessary instability in output, interest rate and exchange rates). Hence, a more explicit dual mandate would recognize the reality of the current IFT regime, as the RBNZ already considers output gaps in its policy decisions. Assuming that monetary policy is neutral in the long term, any numerical objective that is inconsistent with the economy's actual natural rate of unemployment or level of potential output would create an unachievable goal for the central bank. This latter could give rise to time-inconsistent policies ("inflation bias") and in turn, decrease the effectiveness and the credibility of the monetary regime. In addition, as demonstrated earlier, there is uncertainty about the extent of economic slack (as unexpected shocks arose for example during 2012-2016) and, with sizeable supply shocks, it is also time varying.

[11] A simple quadratic loss function was used to approximate welfare. The loss function as defined as Loss = Output Gap^2 + Inflation Gap^2+0.5*change in the official interest rate^2, following Al-Mashat and others (2018).

15. The March 2018 PTA should set the model for the formulation of the employment objective. The forthcoming amendment to the Reserve Bank Act and the setting of monetary policy objectives should follow the current PTA, consistent with the Cabinet Paper (2018) and the Independent Expert Advisory Panel (2018). The Fed and the RBA, the two other dual mandate central banks, also followed the route of a qualitative employment objective (see Box 1).

Figure 7. Illustrative Loss Functions* (2012-2018)



* Loss function as defined as Loss = Output Gap^2 + Inflation Gap^2+0.5*Change in official interest rate^2
Source: Staff estimatates

16. The RBNZ's policy communication will now require greater emphasis on the assessment of maximum sustainable employment. The Fed publishes governors' estimates of the non-accelerating inflation rate of unemployment (NAIRU). The RBNZ has traditionally been reluctant to publish its assessment of the NAIRU, given the wide swings in the unemployment rate, and has instead focused on potential output and the output gap to assess the state of the real economy. But

the *Monetary Policy Statement* of May 2018 (RBNZ, 2018b) contains a thorough assessment on how the RBNZ sees the evolution of "maximum sustainable employment" going forward.

Box 1. The Specification of the Output/Employment Goal for the Fed and the RBA

The legal text for the RBA says that "*… the Reserve Bank Board, will best contribute to: (a) the stability of the currency of Australia; (b) the maintenance of full employment in Australia; and (c) the economic prosperity and welfare of the people of Australia.*"[1] The RBA, however, is not very explicit about the output/employment goal. In explaining policy, it makes only an implicit judgment on how the maintenance of full employment will be achieved. "*The inflation target is defined as a medium-term average rather than as a rate (or band of rates) that must be held at all times. This formulation allows for the inevitable uncertainties that are involved in forecasting, and lags in the effects of monetary policy on the economy. […] This approach allows a role for monetary policy in dampening the fluctuations in output over the course of the cycle.*"

The Fed publishes its assessment on the numerical (though possibly time-variant) normal rate of unemployment and pursues a "balanced approach" in forming policy. The Fed's statute: "*The Board of Governors of the Federal Reserve System and the Federal Open Market Committee shall maintain long-run growth of the monetary and credit aggregates commensurate with the economy's long-run potential to increase production, so as to promote effectively the goals of maximum employment, stable prices, and moderate long-term interest rates.*"[2] When it comes to actual policy "[t]*he Committee judges that inflation at the rate of 2 percent … [and that].. [t]he maximum level of employment is largely determined by nonmonetary factors … [which] may change over time and may not be directly measurable. As a result, the FOMC does not specify a fixed goal for maximum employment. […] Committee participants' estimates of the longer-run normal rate of unemployment ranged from 4.3 to 5.0 percent and had a median value of 4.6 percent.*"[3]

[1] See Reserve Bank of Australia (2018a).

[2] See Federal Reserve System (2018a).

[3] See Federal Reserve System (2018b).

D. Conclusion

17. The Phase One of the Review of the Reserve Bank Act can be regarded as a next step in the gradual evolution of inflation targeting in New Zealand. The new PTA, with its qualitative description of the employment objective, can be regarded as a refinement in the current practice of inflation targeting. The flexible inflation targeting regime was successful in terms of stabilizing output and inflation while maintaining price stability. Recent episodes of inflation undershooting the target serve as an example of uncertainty on the real-time assessment of slack in the economy. The explicit dual mandate will require some changes in the communication of the central bank, including on maximum sustainable employment.

References

Al-Mashat, R., K. Clinton, B. Hunt, Z. Jakab, D. Laxton, H. Wang, and J. Yao, 2018, "Monetary Policy in the New Mediocre," IMF Working Paper, forthcoming.

Adrian, T., Laxton, D. and Obstfeld, M. (eds.), 2018, *Advancing the Frontiers of Monetary Policy*, Washington, D.C.: International Monetary Fund, 2018.

Armstrong, J., 2015, "The Reserve Bank of New Zealand's Output Gap Indicator Suite and its Real-time Properties," RBNZ Analytical Notes, AN2015/08.

Blanchard, O., and J. Galí, 2007, "Real Wage Rigidities and the New Keynesian Model," *Journal of Money, Credit, and Banking* 39(1): 35-65.

Cabinet Paper, 2018, "Modernising New Zealand's Monetary Policy Framework: Phase One," Cabinet paper, accessed at https://treasury.govt.nz/sites/default/files/2018-04/rbnz-rev-cabinet-paper-phase1.pdf on 31 May, 2018.

Clinton, K., C. Freedman, M. Juillard, O. Kamenik, D. Laxton, and H. Wang, 2015, "Inflation-Forecast Targeting: Applying the Principle of Transparency," IMF Working Paper WP/15/132.

Clinton, K., T. Hlédik, T. Holub, D. Laxton, and H. Wang, 2017, "Czech Magic: Implementing Inflation-Forecast Targeting at the CNB," IMF Working Paper No. 17/21.

Debortoli, D., J. Kim, J. Lindé, and C. Nunes, 2017, "Designing a Simple Loss Function for Central Banks: Does a Dual Mandate Make Sense?" IMF Working Paper WP/17/164.

Dincer, N. and B. Eichengreen, 2014, "Central Bank Transparency and Independence: Updates and New Measures," *International Journal of Central Banking* 10(1): 189-259.

Federal Reserve System, 2018a, "Section 2a. Monetary Policy Objectives," accessed at https://www.federalreserve.gov/aboutthefed/section2a.htm on 31 May 2018, referring to 12 USC 225a. As added by act of November 16, 1977 (91 Stat. 1387) and amended by acts of October 27, 1978 (92 Stat. 1897); Aug. 23, 1988 (102 Stat. 1375); and Dec. 27, 2000 (114 Stat. 3028).

_____, 2018b, "What are the Federal Reserve's Objectives in Conducting Monetary Policy?" accessed at https://www.federalreserve.gov/faqs/money_12848.htm on 31 May 2018.

Independent Expert Advisory Panel, 2018, "Review of the Reserve Bank Act," accessed at https://treasury.govt.nz/sites/default/files/2018-04/rbnz-rev-panel-report-phase1.pdf on 31 May 2018.

Laubach, T. and J. C. Williams, 2015, "Measuring the Natural Rate of Interest Redux," Federal Reserve Bank of San Francisco Working Paper 2015-16.

McDermott, J., 2018, "Inflation Targeting in New Zealand: An Experience in Evolution," Speech delivered to the Reserve Bank of Australia Conference on Central Bank Frameworks, in Sydney, 12 April 2018.

Obstfeld, M., K. Clinton, O. Kamenik, D. Laxton, Y. Ustyugova, and H. Wang 2016, "How to Improve Inflation Targeting in Canada," IMF Working Paper No. 16/192.

Reis, 2013, "Central Bank Design," presented at the conference "The First 100 Years of the Federal Reserve," NBER Working Paper 19187.

Reserve Bank of Australia, 2018, "Our Role," accessed at https://www.rba.gov.au/about-rba/our-role.html, on 31 May 2018.

Reserve Bank of New Zealand, 2018a, "New PTA Requires Reserve Bank to Consider Employment Alongside Price Stability Mandate," accessed at https://www.rbnz.govt.nz/news/2018/03/new-pta-requires-reserve-bank-to-consider-employment-alongside-price-stability-mandate on 31 May 2018.

_____, 2018b, Monetary Policy Statement, May 2018.

Riksbank, 2017, "Basis for Decision: Target Variable and Variation Band," accessed at https://www.riksbank.se/globalassets/media/nyheter--pressmeddelanden/pressmeddelanden/2017/bilagor/remis_beslutsunderlag_remiss_170516_eng.pdf, on 11 May 2017.

Rogoff, K., 1985, "The Optimal Degree of Commitment to an Intermediate Monetary Target," *Quarterly Journal of Economics* 100(4): 1169-89.

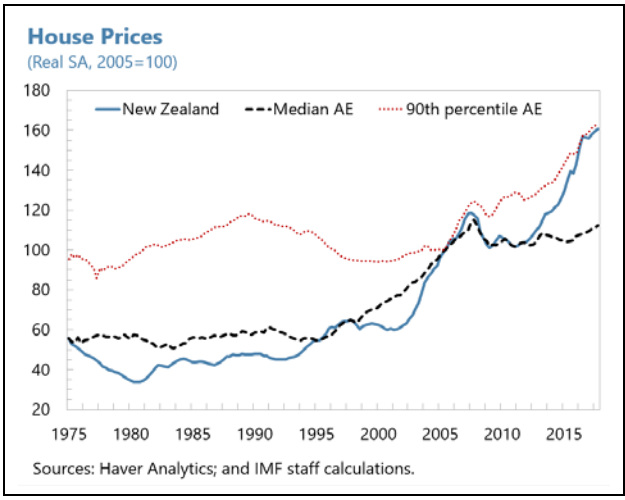
Walsh, C., 2005, "Endogenous Objectives and the Evaluation of Targeting Rules for Monetary Policy," *Journal of Monetary Economics* 52: 889-911.

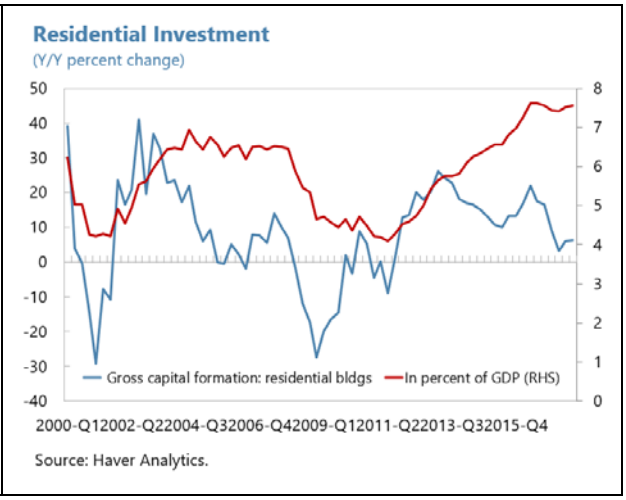
Woodford, M., 2003, *Interest and Prices*, Princeton: Princeton University Press.

HOUSING AFFORDABILITY IN NEW ZEALAND AND POLICY RESPONSE[1]

A. Introduction

1. House prices in New Zealand have risen rapidly since early 2000s. After the housing boom of 2001-07, house prices took a short pause after the global financial crisis (GFC), and resumed a rapid growth path from 2011. During 2011-16, house prices rose by 54 percent (60 percent) in real (nominal) terms or an average 9 percent (10 percent) in real (nominal) terms annually. The surge in house prices in New Zealand has mostly surpassed other advanced economies, in part because it has not experienced a major house price correction.



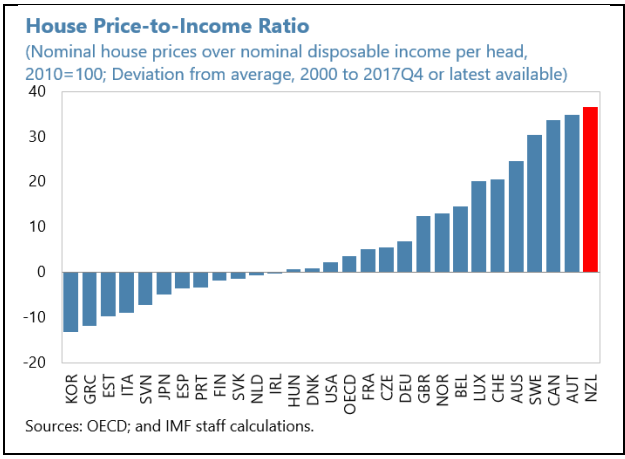


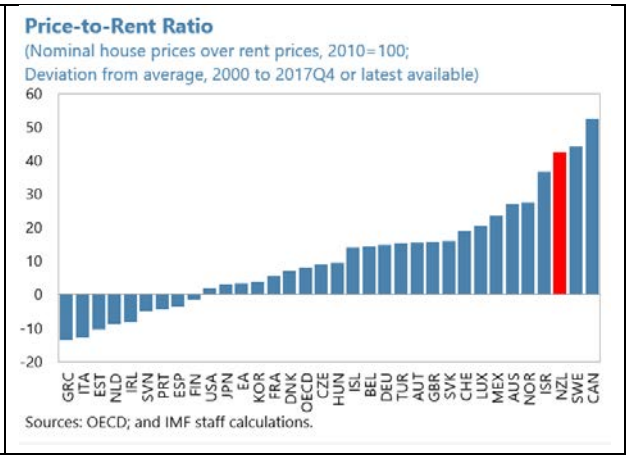
2. The rapid house price growth has resulted in skewed increases in income and rent ratios. These house price valuation metrics put New Zealand above other OECD countries, after large increases in price-to-income and price-to-rent ratios since 2000.

3. The persistent rise in house prices is due to a combination of demand-side factors and stickiness in the housing supply response. Demand for home ownership rises with household income, including upgrades to larger and higher quality houses. The low interest rate environment since the GFC has increased household loan servicing capacity. Combined with the relative ease of obtaining credit as banks have competed for mortgage market shares, low interest rates have boosted growth in housing loans and supported higher house prices. Population has grown rapidly since 2000, driven partly by two waves of strong net immigration. In the most recent surge from 2013-17, almost half of the population increase was recorded in Auckland. With this geographical concentration of the population increase and the associated demand for housing, the price impact of the constrained housing supply response has been particularly large. This is despite residential

[1] Prepared by Yu Ching Wong (APD). The chapter benefited from valuable comments by the Treasury of New Zealand and participants at a roundtable discussion including members of the Treasury, the Ministry of Business, Innovation and Employment, and the Reserve Bank of New Zealand.

investment increasing from 4 percent to 8 percent of GDP during 2011-17, making up nearly a third of all gross fixed capital formation in 2017. In other words, inelastic supply has amplified the impact of the demand shock.





4. **House price increases** became more pronounced around 2015-16. Staff's updated estimate suggested that real house prices are around 20-25 percent higher than the level consistent with economic fundamentals reflecting demand underpinned by affordability (house price to income), real disposable income, working-age population, equity prices, and the level of short and long-term interest rates (Nyberg, 2016). [A large deviation from price fundamentals expose the economy to a higher risk as a disruptive house price correction could put the banking system, with more than 60 percent of credit exposed to residential mortgages, under severe pressure. The resulting credit contraction would further amplify the impact of the downturn on domestic economic activity and the banking sector.

5. **The housing market has cooled recently, but household debt remains elevated. House** prices appeared to have peaked in 2016. Household credit growth has moderated due in part to the impact of loan-to value ratio (LVR) restrictions, banks' tightening of lending standards and marginally higher mortgage rates since early 2017 (Box 1). Nevertheless, the high cost of housing drove household debt further to 168 percent of household disposable income in 2017.

6. **Housing affordability remains a key concern.** For New Zealander, the standard aspiration or the Kiwi dream is centered on the acquisition of a family home. However, as the impact of high house prices persists, affordability has become a political hot-button issue. In response, the recently-elected new government is putting in place a comprehensive program to improve the affordability of housing. Against this background, the rest of this paper reviews how much housing affordability has deteriorated and summarizes recent policy measures to support housing affordability. It also discusses the appropriateness of the policy response and provides suggestions for refinement.

Box 1. Demand Impact of Macroprudential Policy

Financing constraints from loan-to-value ratios (LVRs) restrictions have reduced housing demand temporarily and thereby contributed to slowing house price growth. After three rounds of tightening of LVRs restrictions in October 2013, November 2015 and October 2016, the share of outstanding residential mortgages with LVR above 80 percent has declined to under 8 percent in September 2017, from 21 percent in September 2013 before the imposition of nay LVR restrictions. Bank and household balance sheets have thereby become more resilient with a lower share of loans with high LVRs. The RBNZ relaxed the LVR restrictions marginally as of January 1, 2018, raising for each bank's new mortgage lending to (i) owner occupiers at LVRs of more than 80 percent to no more than 15 percent from previously 10 percent; and (ii) residential property investors at LVRs of more than 65 percent from previously 60 percent while keeping the cap at no more than 5 percent. Going forward, it will be important for the banks to maintain high lending standards, including robust assessment of debt serviceability with rising mortgage rates. The macroprudential toolkit could be strengthened by adding a debt-to-income (DTI) or debt-service-to-income (DSTI) instrument, which in event of a future decrease in interest rates, would just increase housing demand, unless there is the ability to curb it through an additional instrument.

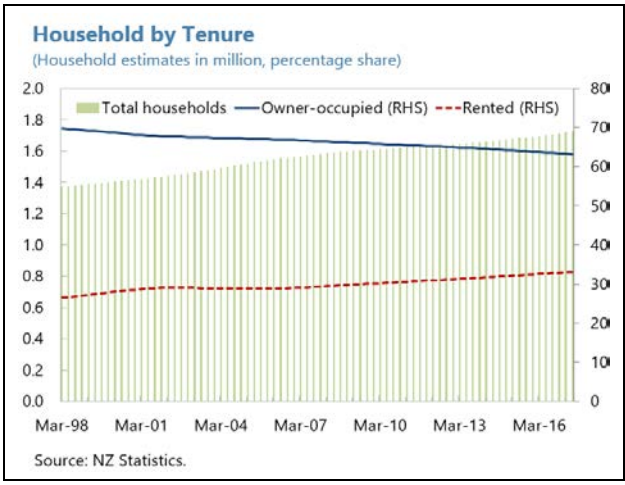
Macroprudential policy is nonetheless not the instrument to address housing affordability. Macroprudential policies aim to manage financial system risk by increasing the resilience of bank balance sheets to a potential shock; and by dampening a credit and asset price cycle on the upswing to reduce the risk and severity of the eventual downturn. In this context, there is a trade-off between macro-prudential policy measures that might make credit less accessible but should help to make house prices more affordable in the longer term. However, as macroprudential policy is not for enhancing social equity, the implications on housing affordability are just positive side effects, not the intended objective.

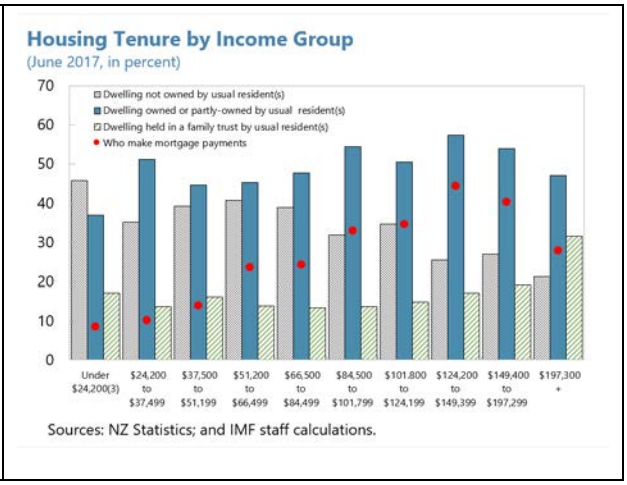
B. How Much Has Housing Affordability Declined?

7. Housing affordability has different implications for renters, potential home-buyers and existing home owners. The concept probably has evolved from "one week's pay for one month's rent" (Hulchanski, 1995), common benchmarks of affordability are expenditures on housing (mortgage repayment, rents) to income ratios in the range of 25-40 percent, focusing more on the lowest 40 percent of income earners or households. Factors that contribute to housing affordability would often include income (affected by labor market condition), house prices and rents (reflecting supply constraints), and interest rates and mortgage term (indicating costs of borrowing). MBIE (2017) defines housing affordability as being able to meet housing costs (either of owning or renting) out of income without having an adverse impact on the ability to afford the basic living requirements, recognizing that determining affordability depends on each household's circumstances and expectations of what qualifies as a socially accepted standard of living. Given heterogeneity in the level of affordability, there are inherent difficulties in measuring housing affordability with simple averages across house prices and household incomes.

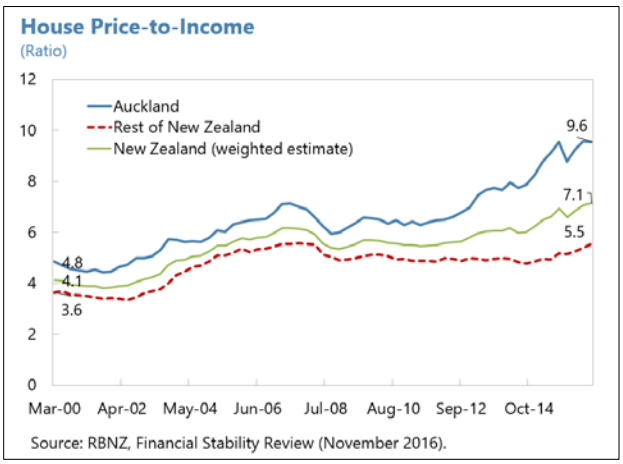
8. Housing affordability in general has not deteriorated much because of the large decline in interest rates since the GFC. The decline in residential mortgage rates (floating rate for new customers) from an average 8.7 percent in 2000-08 to 6.1 percent in 2009-15, and further to 5.7 percent since 2016 against the global low interest rates environment has largely offset the impact of higher house prices on mortgage costs. The remaining of this paragraph summarizes some standard affordability indicators, with the appropriate caveats.

- ***Household by tenure***. Home ownership has been declining from more than 70 percent during 1990-97 to 63 percent of the total households in June 2017.[2] At a broad level, a decline in home ownership could indicate a deterioration of housing affordability, assuming there are no underlying changes in ownership preference. However, the share of owner and tenant households vary widely across countries while in most countries more than two out of three households own their dwelling (OECD, 2016). On the other hand, in New Zealand, the share of dwelling not owned by its primary resident is higher in lower income quantiles relative to higher quantiles, which is consistent with the global pattern that a household's likelihood of home ownership increases with income.





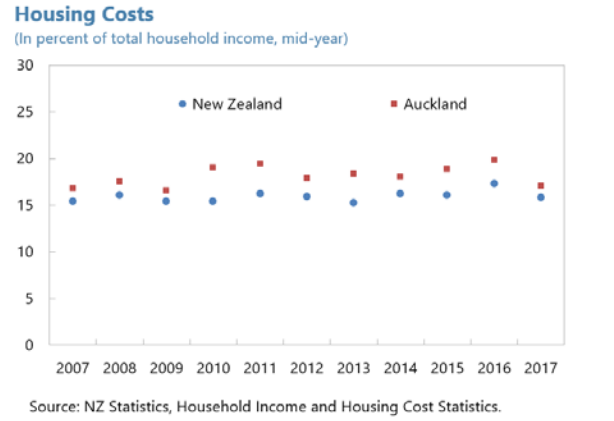
- ***House price-to-income ratio.*** The nationwide house price-to-income ratio rose rapidly to about 7 from below 3 in the early 1990s, with a widening wedge between Auckland and the rest of New Zealand since 2013. While this indicator is simple to compile and widely used for cross-country and time series comparison, it does not reflect the level of housing related expenses such as the prevailing interest rate (see further analysis below).

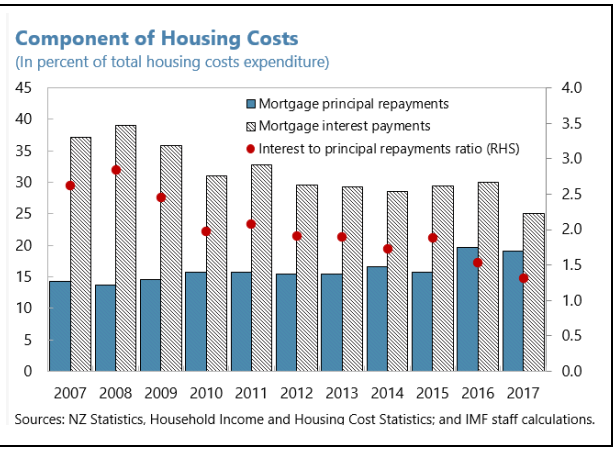


- ***Housing cost indicators***. Housing cost indicators suggest that affordability in general has not changed much over the last decade, with average housing costs remaining at below 20 percent of household income. The ratio in 2016 marginally exceeded the previous peak in 2011 but has since declined in 2017, with the national average at 15.8 percent and Auckland at 17 percent. In terms of the distribution at different cost thresholds, 71 percent of all households have housing

[2] Stats NZ estimates of households and dwellings by tenure show that the number of dwellings either rented or provided rent-free to occupants grew almost 23 percent between 2007 and 2017, while the total number of dwellings grew only 11 percent (MBIE, 2018).

costs at less than 25 percent of total household income in 2017 at the national level, compared with 11 percent of households that have housing costs at more than 40 percent of total household income. The mortgage interest to principal repayment ratio declined to 1.3 in 2017 from 2.8 in 2008. Historically low interest rates level has helped keep total housing costs largely unchanged despite higher principal repayment required for larger housing loan.



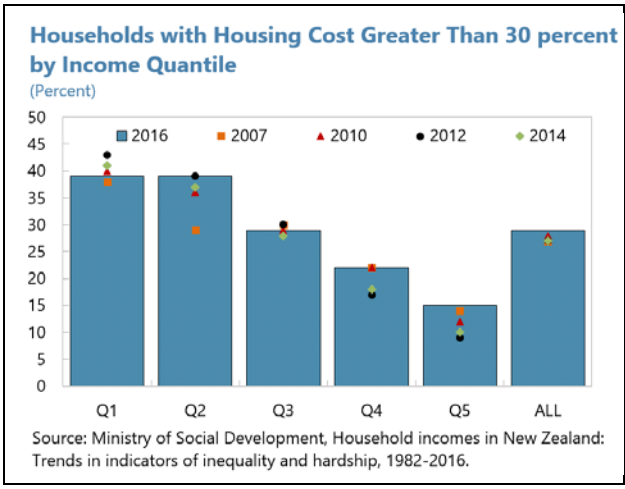


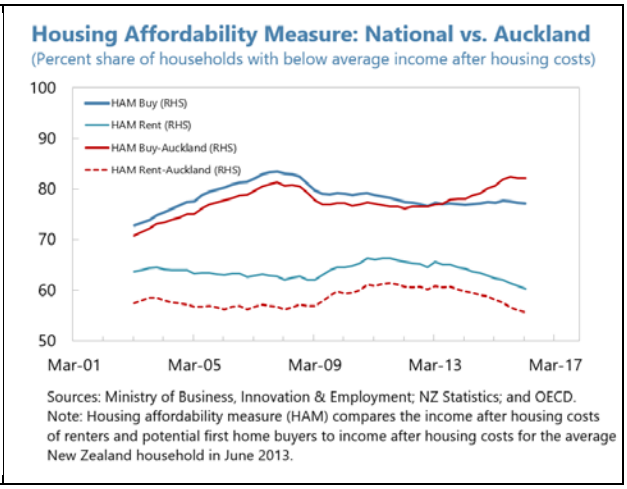
9. Some segments of the population however suffered a larger deterioration in housing affordability. Lower income groups are naturally more adversely affected by declining housing affordability given their smaller income buffer net of living expenses. This includes renters, accounting for a higher share in lower income groups, who are exposed to higher rents in private rental markets if the impact of housing shortages pushes up rent. As for first home buyers, increasing house prices is a growing barrier delaying their entry into home ownership, since it takes longer to save for a mortgage down payment and requires a higher level of debt servicing capacity. even with low interest rates.

- ***Lower income households.*** Using an outgoing-expenditure-to-income ratio (OTI) of 30 percent as a benchmark for high OTIs, 29 percent of households had high OTIs in 2016, compared to only one in five in the early 1990s. Unsurprisingly, 39 percent of households in the bottom two income quantiles had high OTIs in 2016, considerably higher than 22 percent for the second highest and 15 percent for the highest income quantile. While affordability has been broadly unchanged over 2007-16, households in the second-lowest income quantile experienced a considerable increase in their OITs from 29 percent in 2007.

- ***First-home buyers and renters***. A new Housing Affordability Measure (HAM) compiled by the MBIE examines household incomes, subtracting the cost of buying or renting and compares that to a 2013 benchmark to track affordability over time.[3] The share of potential first home-

[3] Income after housing costs for the average New Zealand household is NZ$662 per week for a one-person household. This amount is adjusted for household size.





buyer households with below average income after housing costs increased to 82 percent in 2016Q1 in Auckland, compared to 77 percent at the national level. In contrast, the share of renter households with below average income net of housing costs decreased to 60 percent in 2016Q1 from 66 percent in 2011Q2. For Auckland, HAM suggested a similar declining trend for renter households to 56 percent in 2016Q1 from 61 percent in 2011Q2. Taking the above two HAMs together, the outlook does look dim if an existing renter were to also save to purchase a home (see further discussion in Box 2). In this regard, the HAM could be usefully extended to measure the number of years needed for a potential first home-buyer to save for a mortgage down payment.

10. The central group subject to the affordability problem is new entrants to the labor market with little of the savings needed for home ownership. Rising house prices pose increasing difficulties for first-time home buyer as the national median house price rose to NZ$550,000 in December 2017 from NZ$520,000 a year ago, while Auckland's median rose to NZ$870,000 from NZ$855,000 over the same period. This translates into a house price-to-income ratio of 6.4 for the national median and 6.7 for Auckland. To estimate housing affordability for a first-time home buyer, a 20 percent down payment is assumed with associated monthly repayment costs of a 5-year fixed rate mortgage as of April 2018 on a 30-year annuity payment, to determine the debt service-to-income (DSTI) ratio. Also assumed is a maximum allowable DSTI at 30 percent to derive a corresponding affordable house price. The results in Table 1 illustrate that at existing median house price at the national level and in Auckland, DSTI ratios would rise to 37 percent and 56 percent, respectively (Scenario A). Alternatively, if the home buyer has an objective to achieve a more comfortable DSTI ratio at 30 percent, the implied affordable median house price level would be NZ$451,000 (18 percent lower than actual) at the national level and NZ$466,000 (46 percent lower than actual) in Auckland (Scenario B). The illustration also shows that with the higher DSTI, it will take 4.2 years (4.5 years) at the national level (in Auckland) to save for a 20 percent mortgage

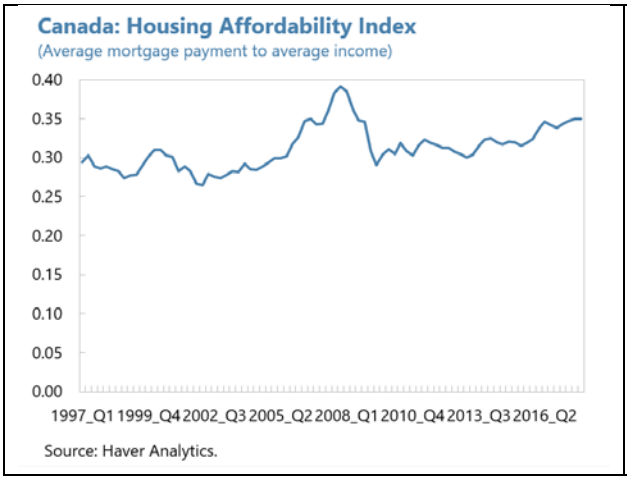
down payment to purchase a median price house assuming a relatively high saving rate at 30 percent of household income.[4]

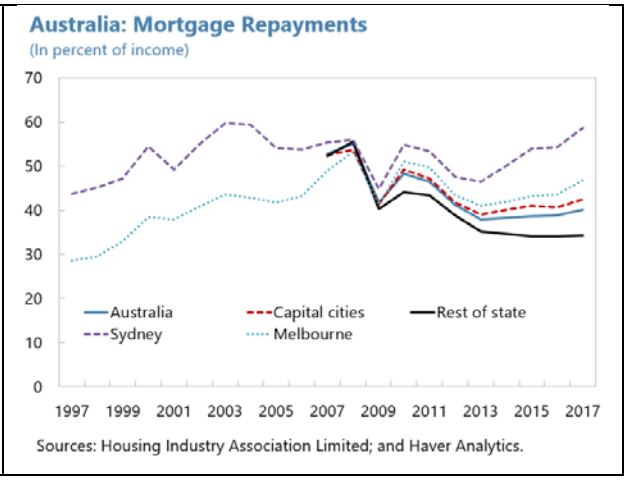
Table 1. Illustrative Housing Affordability Scenario

	National Scenario		Auckland Scenario	
	A	B	A	B
Median house price (Dec 2017)	550,000	450,752	870,000	465,898
Median annual household income (Jun 2017)1/	86,392	86,392	129,165	129,165
House price-to-income ratio	6.4	5.2	6.7	3.6
Mortgage down payment	20%	20%	20%	20%
Mortgage interest rate (5-year)	5.9%	5.9%	5.9%	5.9%
Amortization (year)	30	30	30	30
Debt service-to-income ratio	36.6%	30.0%	56.0%	30.0%
Years to save for down payment	4.2	3.5	4.5	2.4
House price above affordability by	-	-18%	-	-46%

1/ Average annual household income is used for Auckland instead due to the lack of data.
Sources: REINZ, NZ Statistics; and IMF staff calculations.

11. Overall housing affordability in New Zealand is broadly comparable with trends in other advanced economies facing similar challenges from housing booms. For Canada, housing affordability has deteriorated after an improvement post-GFC, with the average mortgage payment reaching 35 percent of average income in 2017. In Australia, mortgage repayments in capital cities have crept up since 2013, accounting for 42.5 percent of average earnings in 2017 while the steepest increase was in Sydney where mortgage repayments used up close to 60 percent of income. These levels are considerably higher than the 30 percent threshold in Australia which demarcates affordable conditions for an average first home buyer.





[4] MBIE (2018) compared average wages of employees and median house prices to calculate the number of years at this wage required to purchase the median priced house. It showed that to the extent to which Auckland's house prices have risen much faster than wages – it would require a rise from around ten years' wages in early 2012 to 16 years in 2016 although with a slight easing more recently.

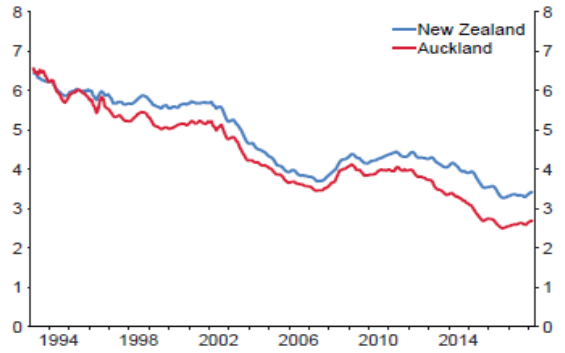
Box 2. Private Rental Market

Rental yield in New Zealand, as in most advanced economies, has been declining since the 1990s. Rental yield—the rent a property could potentially generate in a year expressed as a percentage of its purchase price—has fallen to 2.5-3.5 percent in 2017 from 6-7 percent in the early 1990s as house prices have risen faster than rents (RBNZ 2018). Low and falling yield could indicate that residential investors are buying properties mainly because of expected capital gains that far outstrip rental income.

The cost of renting is expected to pick up as the housing market rebalances. Private rents, as reported by MBIE based on mean rents (from bonds lodged with Tenancy Services), rose on average just below 5 percent annually in the last 5 years, largely consistent with inflation and growth in earnings, as opposed to house price inflation. The relative stability of rents while house prices were rising more rapidly has allowed the rental market to act as a "safety valve' for households that cannot afford to own a house. However, this apparent disconnect between house prices and the rents may disappear when higher demand for rental housing, in part as home ownership becomes less affordable, begin to push up private market rents. Moreover, the recent rapid increase in short-term rentals, particularly in Auckland, along with the tourism boom may also reduce rental availability and push up rents.

A shortage of affordable housing for private rental or ownership also poses challenges for social housing. Government intervention is in general needed more on the weaker end of the housing continuum starting with emergency and transitional housing, social housing, and subsidized private rental, and much less in private rental and ownership markets (MBIE 2017). Housing New Zealand manages more than 64,500 social housing units (June/August 2017) nationwide but the stock is clearly not sufficient to meet the demand for lower income families. As more low-income households may have to rent from the private rental market, a surge in private rents would put many into precarious situations.

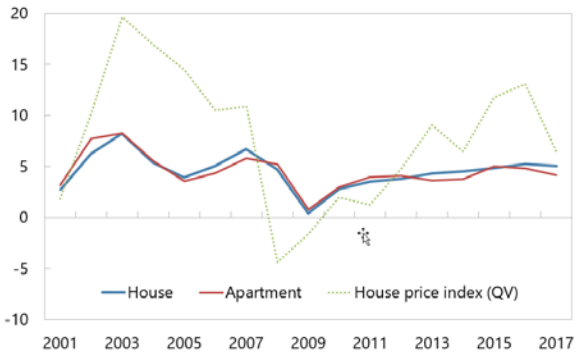
Rental Yields



Source: RBNZ Macro-Prudential Chartpack, March 2018.

Dwelling Rents

(Y/Y percent change)



Sources: MBIE Detailed Mean Rents; Haver Analytics; and IMF staff calculations.

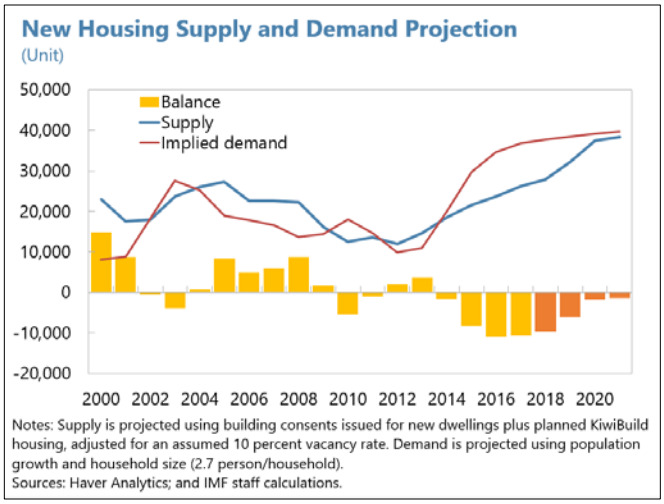
C. Supply-Side Policy Response to Improve Housing Affordability

12. Creating responsive housing supply is key to improve housing market imbalances. The authorities estimated the nationwide housing shortfall at more than 70,000 homes in 2017, of which the shortage in Auckland accounts for around 45,000 units. Relieving chronic housing supply constraints would require policy action to address bottlenecks including land markets, infrastructure, and the construction sector. Increasing land supply and more efficient use of land through improving planning rules and zoning would lower cost of housing. For instance, the new Auckland Unitary Plan appears to have freed up significantly development capacity over previous plans, over a larger geographic area. Infrastructure to support housing development would need to overcome

often financing constraints faced by local governments. The significant price mark-up to construction costs suggests that housing prices would be lower in more competitive markets. Improving the capacity and competition in the construction sector would help to improve the price and quality of housing.

13. Direct government intervention through the KiwiBuild program to supply affordable housing. The government's new KiwiBuild program announced in late 2017 aims to build 100,000 affordable housing units over 10 years to address the housing shortfall. One-half of the KiwiBuild housing units are planned for Auckland where the housing shortage is more severe than the rest of the nation. With an initial financing of NZ$2 billion, the program is expected to be financed subsequently through sales of completed houses to first-time home buyers. While details of the KiwiBuild program are being planned and rolled out, at present, KiwiBuild dwellings (one-bedroom and outside of Auckland and Queenstown) will be priced at or below NZ$500,000. For the starting first three years, the bulk of the targeted 16,000 units will be constructed as part of private development underwritten by the KiwiBuild program. If it is as effectively implemented as planned, the increase supply of housing from the KiwiBuild program would help to close the housing gap based on current assumptions and forecasts for underlying demand.

14. The KiwiBuild program should aim to promote cost and price efficiency while limiting market distortions. The main rationale for the government's direct involvement in an affordable private housing program should be to focus on creating the certainty needed to redirect builders' incentives (including easier bank funding under guaranteed prices for KiwiBuild homes), and bringing necessary reforms in the construction sector. For instance, the adoption of new building technology would promote more cost-effective construction. Similarly, easing land use regulation would help to reduce the large price-cost markups (Lees, 2017). Given the current labor supply constraint in the construction sector, the KiwiBuild program would also require a smooth implementation of the announced special visa program to augment skilled labor. Overall, the proposed increase in homes under the program should not crowd out private residential construction by adding to supply side constraints.



Notes: Supply is projected using building consents issued for new dwellings plus planned KiwiBuild housing, adjusted for an assumed 10 percent vacancy rate. Demand is projected using population growth and household size (2.7 person/household).
Sources: Haver Analytics; and IMF staff calculations.

15. The effective delivery of the KiwiBuild program will depend critically on harnessing complementary reforms. These should include increasing land supply, improving planning and zoning, and increasing local governments' financing and capacity for supporting infrastructure. At the same time, the government's Urban Growth Agenda's aims to enhance land market competition, which if successfully implemented will address over-regulation, under-funding and fragmented

planning. Together the two, should contribute to building enough homes and infrastructure to support the population.

D. Demand-Side Policy Response to Housing Imbalances

16. Foreign buyers appear to have played a minor role in New Zealand's residential real estate markets recently. Similar to other advanced economies with favorable investment climate, global capital inflows appeared to have played an increasingly important role in augmenting housing demand in New Zealand. However, the extent to which non-resident investors have impacted quantity and price pressures are difficult to quantify due to the paucity of data. Property transfer and tax residency data collected under the Land Transfer Amendment Act from Oct 1, 2015 provide limited data in capturing foreign investors' share in the real estate market. Based on these data, about 3 percent of all buyers nationwide and 5 percent of buyers in Auckland have overseas tax residency in 2017 (Table 2). The share of overseas tax resident buyers appears to have increased from around 1 percent in 2015 when this set of data first became available.[5]

Table 2. Tax Residency of Buyer

	New Zealand						Auckland					
				Share in percent						Share in percent		
	2015Q4	2016	2017	2015Q4	2016	2017	2015Q4	2016	2017	2015Q4	2016	2017
Main home & other transfers	10,761	77,763	72,171	20.4	37.5	40.3	2,457	18,411	16,860	16.8	31.9	35.0
Other tax residency stated was NZL	15,507	119,307	101,346	29.4	57.5	56.6	4,113	35,061	28,901	28.2	60.7	59.9
No statement required due to contract date	25,884	5,061	-	49.1	2.4	-	7,830	1,776	-	53.7	3.1	-
Other	534	5,467	5,682	1.0	2.6	3.2	183	2,541	2,493	1.3	4.4	5.2
Australia	156	1,308	1,359	0.3	0.6	0.8	30	201	228	0.2	0.3	0.5
China	123	1,710	1,557	0.2	0.8	0.9	90	1,437	1,269	0.6	2.5	2.6
Hong Kong SAR	21	171	240	0.0	0.1	0.1	12	39	84	0.1	0.1	0.2
U.K.	36	366	315	0.1	0.2	0.2	-	24	-	-	0.0	-
U.S.	27	222	276	0.1	0.1	0.2	-	18	-	-	0.0	-
Mixed inl. NZ	93	741	957	0.2	0.4	0.5	33	258	315	0.2	0.4	0.7
Singapore	18	150	-	0.0	0.1	-	-	45	-	-	0.1	-
Others	60	798	978	0.1	0.4	0.5	18	519	597	0.1	0.9	1.2
Total	52,686	207,598	179,199	100.0	100.0	100.0	14,583	57,789	48,234	100.0	100	100

Sources: Land Information New Zealand; and IMF staff calculations.

17. A ban of residential real estate purchases by nonresidents is therefore unlikely to significantly improve housing affordability. The draft amendment to the Overseas Investment Act currently under the parliament's consideration aims to restrict non-residents' purchase of existing residential properties by bringing all residential land under the Overseas Investment Act's definition of "sensitive land" which requires approval for purchases by non-residents. The proposed screening regime allows overseas persons to obtain consent to acquire residential land where they are committed to reside, and become tax resident, in New Zealand; where their investment will increase housing supply; or where they will develop the land for other purposes (such as commercial premises). However, this ban on foreign home ownership could discourage potential foreign direct

[5] Further, based on more detailed data collected since Dec 2016, in 82 percent of all property transfers, one or more buyers were citizens or residents. Transfers in which none of the buyers being citizens or residents accounted for 2 percent (either at least one buyer had either a student or work visa or had immediate family with New Zealand citizenship/residency/work or student visa), whereas transfers which buyers are represented by corporate or business entities accounted for 16 percent. For transactions in Auckland, the share of transfers which buyers are not citizens or residents is higher at around 4 percent and transfers involving buyers that are corporate or business entities is about 20 percent.

investment that could help build more houses. The broad housing policy agenda consisting of supply initiatives including the KiwiBuild program and reducing tax incentives (discussed below), if fully implemented, would address most of the potential problems associated with foreign buyers more effectively and on a non-discriminatory basis.

18. Tax incentives have favored investments in residential housing. Property investors accounted for slightly above 35 percent of total purchases during 2014-16, before declining marginally to below 35 percent in 2017, while the share of first home buyers has been largely stable at around 20-22 percent during 2013-17.[6] At the same time, tax incentives might have accentuated the house price increase as they affect an investor's demand response to a price or yield shock. Therefore, reducing the preferential treatment for investment in real estate would reduce incentives to buy real estate as an investment product, and reduce demand and supply imbalances in the housing sector.

19. Redirecting savings from housing to other investments to reduce housing demand could also help affordability. To dampen property speculation, the bright-line test on residential property sales introduced in October 1, 2015 had its threshold extended to five years from two years. Any residential properties other than main home acquired after March 29, 2018 will be subject to tax if disposed of within five years of acquisition. The government has also proposed to limit negative gearing from rental properties, such that the deductibility of net losses from property investment from other taxable income would be eliminated. Further, a Tax Working Group is considering possible additional reform, including a broader capital gains tax on housing investment (while still excluding primary residences) and possibly a land tax reform (also excluding primary residences). However, *ad valorem* land tax for local governments could be introduced to secure infrastructure funding to support housing development, as user fees only cover new developments which do not meet the needs in existing neighborhoods.

E. Summary and Conclusions

20. The housing market is cooling but managing housing-related risks remain challenging. Rising house prices were associated with rapid household credit growth through 2016. Given the slower rise in income, house price-to-income ratios reached unprecedented levels, especially in Auckland where the surge in house prices has been stronger. Household credit growth has moderated in 2017 while household debt continued to rise from already high levels. Given the underlying shortages in housing supply, the moderation in house prices is expected to be slow.

21. Affordability concerns have also become more pressing, especially for first-time home buyers. The deterioration in housing affordability because of high house prices as measured by housing cost to income has been partially offset by lower interest rates. Lower income groups remain more adversely affected by declining housing affordability. Rising house prices pose increasing difficulties for first-time home buyers entering the home market as it increases the length

[6] RBNZ, 2018 Macroprudential Chart Pack, Chart 5D, March 2018.

of time needed to save for a mortgage down payment regardless of the level of interest rates, and lead to higher debt servicing requirements as they need to have a larger mortgage than in the past.

22. The housing policy agenda is ambitious and appropriately focuses on closing key gaps on the supply side and in the tax system. Housing supply shortfalls have contributed to the run-up in house prices, reflecting supply constraints amid strong demand fundamentals, including rising net migration, lower interest rates, and stronger income growth. While demand-side drivers have stabilized, they remain robust, and improved housing affordability requires eliminating supply bottlenecks. Supply and demand sides reforms are complementary, and the success of the housing policy agenda will depend on well-coordinated progress on all fronts.

23. Lastly, improving the availability of housing affordability and other related statistical data is important. Further effort to compile and regularly release key housing related indicators such as house prices, housing costs, housing ownership and affordability measures would help to enhance analysis and inform policy decisions.

References

A. Johnson, P. Howden-Chapman and S. Eaqub, 2018, *A Stock Take of New Zealand Housing—February 2018*, Ministry of Business, Innovation and Employment (MBIE).

Nyberg, D., 2016, "House Prices, Household Debt, and Financial Stability Risks in New Zealand," *IMF Selected Issues Paper*, IMF Country Report No. 16/40.

Hulchanski, J., 1995, "The Concept of Housing Affordability: Six Contemporary Uses of the Housing Expenditure-to-Income Ratio," *Journal of Housing Studies* 10(4): 471-491.

Lees, K., 2017, "Quantifying the Impact of Land Use Regulation: Evidence from New Zealand," Sense Partners, report for Superu, Ministerial Social Sector Research Fund, June 2017.

M. Robinson, G. Scobie, and B. Hallinan, 2006, "Affordability of Housing: Concepts, Measurement and Evidence," *Working Paper* 06/03, The Treasury.

MBIE, 2017, *Briefing for the Incoming Minister of Housing & Development*, October 25, New Zealand Government.

OECD, 2016, Affordability Housing Database.

Productivity Commission, 2012, *Housing Affordability Inquiry*, March 2012.

RBNZ, 2013, "Macro-prudential policy and the New Zealand Housing Market," speech by Mr. Grant Spencer, Deputy Governor and Head of Financial Stability of the Reserve Bank of New Zealand, to the Business NZ Council, Wellington, New Zealand, 27 June 2013.

PRODUCTIVITY AND PROFITABILITY IN NEW ZEALAND: THE ROLE OF LEVERAGE, R&D, AND INVESTMENT[1]

A. Introduction

1. New Zealand's productivity growth has been relatively low compared to other advanced economies despite pioneering structural reforms. This is puzzling because New Zealand has been a front-runner of structural reforms, including state-owned enterprise reforms, transparent institutions, strong property rights, and others. A widely accepted explanation of the puzzle has been New Zealand's geographical remoteness and its small, insular market, which have led to limited technological diffusion from global supply chains and less incentives for innovation owing to small size of domestic market and firms (McCann 2009).

2. This paper analyzes New Zealand's recent productivity performance from a firm-level perspective, focusing on the role of corporate leverage. A growing number of empirical studies has tried to find evidence on productivity enablers and innovation enhancers in New Zealand. The focus has been on productivity spillovers from foreign direct investment (Doan and others 2015), the size of firms (Hong and others 2016), agglomeration effects (Maré and Graham 2013), intangible investment (Chappell and Jaffe 2018), exports (Fabling and Sanderson 2013), and research and development (R&D) grants (Le and Jaffe 2017). So far, the literature has not focused on the role of firms' capital structure in the context of productivity, except Smith and others (2012) who finds long-term debt is negatively associated with profitability of publicly listed firms. Against this backdrop, this paper studies the recent productivity performance of New Zealand firms, focusing on the role of leverage. The analysis draws on firm level data from the Orbis database. The Orbis database covers both listed and unlisted private companies. It provides financial data, including balance sheet and profit and loss account. However, the data sample is unbalanced in the time dimension, as New Zealand firm representation in Orbis prior to the mid-2000s is scant.

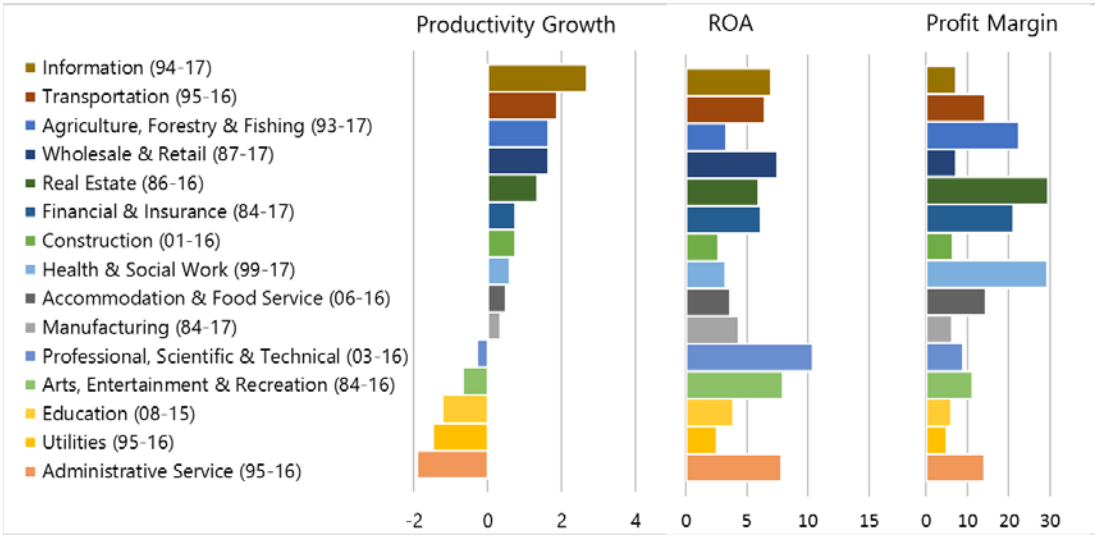
3. The firm performance in New Zealand shows a general tendency toward stronger firm profitability after the Global Financial Crisis (GFC). New Zealand firms generally reduced leverage and capital investment after the GFC. At the industry level, there is some evidence that credit and investment have shifted toward high productivity sectors, indicating greater scrutiny on firm performance for credit extension after the GFC. Furthermore, R&D expenses are positively correlated with profitability in firms that are at the productivity frontier, but not in other firms. This implies a need for increasing the R&D capability of non-frontier firms. Also, low leveraged-firms spend more on R&D.

[1] Prepared by Ryota Nakatani (APD). The author thanks seminar participants at the IMF Article IV Consultation Mission Seminar held at the New Zealand Treasury in Wellington and the Asia and Pacific Department Discussion Forum held at the IMF in Washington, D.C. for comments and feedback.

B. Analysis

4. The paper analyzes firm productivity using two proxy performance measures. Unfortunately, the Orbis database does not allow for the calculation of a sufficiently large panel data set of firm-level productivity. The paper therefore uses other firm performance measures. Specifically, it uses two profitability measures: profit margins (profits as a percent of sales) and the return on assets (ROA). These measures have been used elsewhere as proxy measures for productivity. Indeed, the relationship between productivity growth and average values for the profitability measures across industries suggests some positive correlation (Figure 1). In New Zealand, the multifactor productivities of information, transportation, agriculture, wholesale and retail, and real estate industries grew strongly over the sample period. Meanwhile, ROAs of information, transportation, wholesale and retail, and real estate industries are also relatively high. Although ROA of agricultural industry is not so high in Orbis data, its profit margin is high. In contrast, productivity growth in manufacturing, construction and utilities industries has been near zero or negative, and their ROAs and profit margins are also lower.

Figure 1. Productivity and Profitability



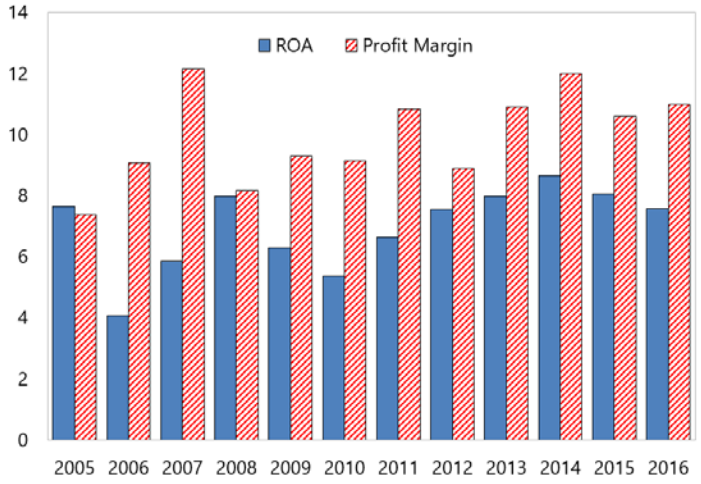
Notes: Productivity growth is sectoral data. ROA and profit margin are based on firm-level data.
Source: Statistics New Zealand; Orbis; and IMF staff calculations.

5. Average ROA and profit margins increased after a drop during the GFC. Figure 2 shows the average profitability across firms over time. ROAs and profit margins declined during the GFC. In the subsequent recovery, both profitability measures rebounded and increased steadily until 2014 when the negative commodity price shock hit the economy. Nevertheless, both profitability measures remained close to average (ROAs) or slightly above (profit margins). Overall, profitability in

the economic expansion after the GFC appears to be somewhat stronger than in the 3 years before the GFC.[2]

Figure 2. Recent Development of Firm Performance Indicators

(In percent, annual average across firms)



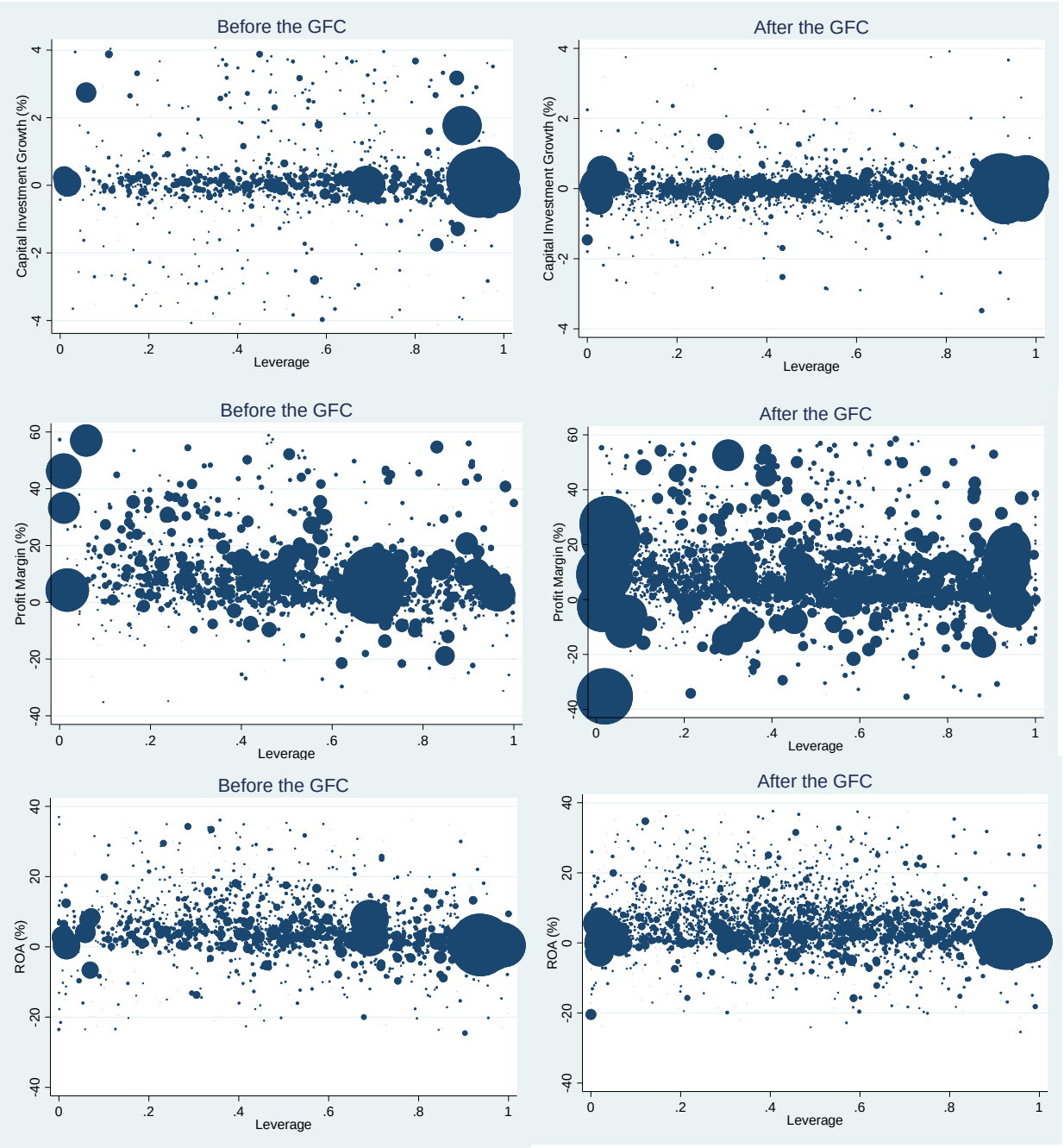
Sources: Orbis; and IMF staff calculations.

6. At the industry level, there was a broad tendency toward stronger profitability after the GFC. Broadly speaking, more productive industries had higher ROAs and, in many cases, higher profit margins after the GFC. The comparison by industry also suggests that investment was stronger in high productivity sectors and a tendency toward lower leverage after the GFC. As for leverage (liabilities to assets), industries with lower productivity rankings have reduced leverage more than others since the GFC. In contrast, industries with higher productivity rankings saw higher leverage and investment after the GFC. Overall, this evidence seems consistent with greater scrutiny on firm performance for credit extension after the GFC.

7. A similar picture emerges at the firm level (Figure 3). Looking at the same variables from a firm-level rather than an industry perspective suggests that the profitability of New Zealand firms increased after the GFC on average. Leverage ratios, in contrast, declined in general after the GFC, with the distribution across firms becoming more bimodal. This implies that some firms improved profitability with higher leverage and other firms with lower leverage. Another noteworthy feature of the data is larger firms tended to have higher leverage and display stronger investment growth. The performance of some large firms notwithstanding, the growth rate of capital investment in nominal terms turned from being positive before the GFC to being negative on average after the GFC.

[2] The short sample period before the GFC is due to the lack of data.

Figure 3. Leverage, Investment and Profitability Before and After the GFC



Note: The sample is scaled by total assets. Financial companies are excluded. The sample is trimmed at the mean plus/minus 2 times standard deviation of capital investment, profit margin and ROA.

Sources: Orbis; and IMF staff calculations.

8. High-leveraged firms reduced leverage and investment after the GFC. The stylized facts at the firm and industry levels suggest a tendency toward lower leverage and investment after the GFC. To examine whether pre-GFC leverage was indeed a driving force in firm behavior and performance after the GFC, whether above average leverage before the GFC has had predictive content for post-GFC changes in the variables discussed so far is examined. Table 1 shows the results of a regression of the changes in various firm variables on the initial leverage levels in 2007 immediately before the GFC. The regression includes industry-dummies, to control for differences in leverage across industries. The firm variables examined include changes in leverage, ROA, and profit margin from 2007 to 2016, as well as changes in the average investment growth rate before and after the GFC. The results in Table 1 shows that the coefficients on leverage are negative and statistically significant at the 1 percent level for leverage and investment growth. The negative coefficient on initial leverage condition implies that firms whose leverage had been above average pre-GFC deleveraged after the GFC. A similar story holds for investment.

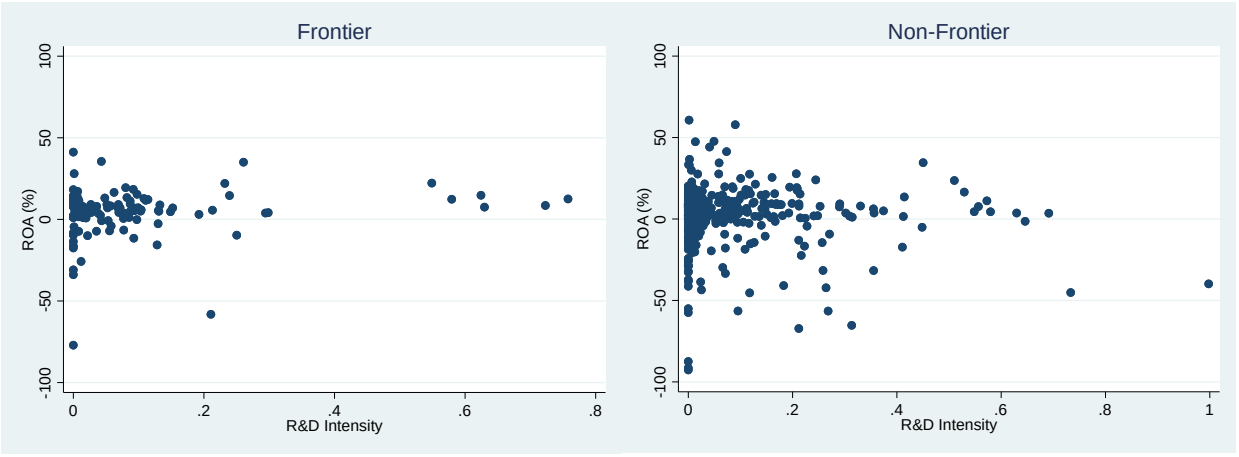
Table 1. Pooled OLS Regression Results with Industry Fixed Effects

Dependent Variable	$\Delta Leverage_{2016\text{-}2007}$	$\Delta ROA_{2016\text{-}2007}$	$\Delta Profit\ Margin_{2016\text{-}2007}$	$\Delta Average\ Investment\ Growth_{\text{after GFC-before GFC}}$
$Leverage_{i,j,2007}$	-0.373*** (0.037)	-4.355 (2.793)	-4.154 (2.770)	-3.49×10^{8}*** (1.21×10^{8})
Constant	0.157*** (0.022)	1.511 (1.608)	-2.047 (1.554)	3.42×10^{8}*** (6.97×10^{7})
Observations	708	689	635	629

Note: ***Statistically significant at the 1 percent level. Standard errors are in parentheses.
Source: Orbis; and IMF staff estimates.

9. R&D expenses are positively correlated with profitability for firms at the productivity frontier. Another important driver of productivity is R&D. Figure 4 shows the relationship between firm performance, as measured by the ROA, and R&D intensity, defined as the share of R&D expenses in operating expenses. The relationship is compared between firms at the productivity frontier and other firms. The former are firms in industries in which productivity growth and profitability (ROA) are both relatively high in New Zealand. The relevant frontier industries include information technology, transportation, agriculture, wholesale and retail, and real estate industries (see Figure 1). Figure 4 highlights the positive correlation between profitability and R&D intensity in the case of frontier firms. This supports the idea that R&D activity enhances innovation, which leads to higher productivity. By contrast, the correlation between R&D and ROA is negative in the case of other firms. Put differently, R&D in the latter does not necessarily lead to higher firm performance in New Zealand. This may imply the limited R&D capability of New Zealand firms in non-frontier industries. This result is consistent with the finding by Wakeman and Conway (2017) who also find that the relative returns of innovating firms are generally negative among the least productive New Zealand firms. Thus, it could be important to increase the R&D capability of non-frontier firms to raise productivity in New Zealand.

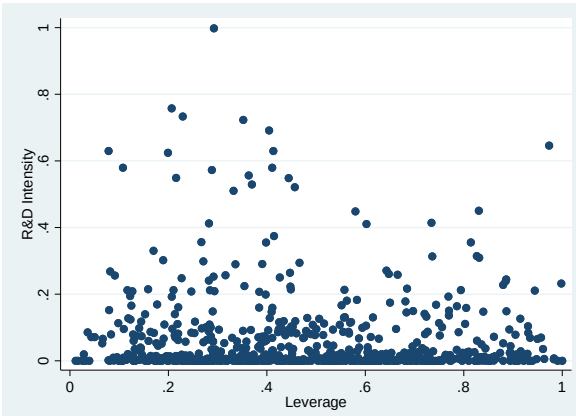
Figure 4. Productivity Frontier versus Non-Frontier Firms



Source: Orbis; and IMF staff calculations.

10. Lower leveraged-firms spend more on R&D. Finally, the relationship between R&D and leverage is investigated because financing conditions can affect R&D activity. Figure 5 shows a negative correlation between leverage and R&D spending. This implies that low-leveraged firms tend to invest more in R&D. Although the causal relationship between these two variables is not investigated, a possible explanation is that low-leveraged firms are deemed to be less credit constrained and they have more room for investing in innovative activity.

Figure 5. R&D Intensity and Leverage



Sources: Orbis; and IMF staff calculations.

C. Conclusion

11. A firm-level analysis of profitability, leverage, and investment in New Zealand suggests that a general tendency toward stronger firm profitability after the GFC. The firm profitability measures used in the analysis are considered proxy variables for productivity performance. At the same time, firms generally reduced leverage after the GFC, except for some larger firms, suggesting that leverage may have increased too much before the GFC. For many firms, the flipside to reduced leverage was reduced capital investment. At the industry level, there is some evidence that credit and investment have shifted toward industries with higher productivity growth. Furthermore, R&D expenses are positively correlated with profitability in firms that are at the productivity frontier, but not in other firms. Overall, these findings would be consistent with the view that there has been increased scrutiny in credit extension after the GFC and a lower willingness for firms to take on risks, including from smaller firms.

References

Chappell, N. and A. Jaffe, 2018, "Intangible Investment and Firm Performance," *Review of Industrial Organization* 52: 509-559.

Doan, T., D. Maré and K. Iyer, 2015, "Productivity Spillovers from Foreign Direct Investment in New Zealand," *New Zealand Economic Papers* 49: 249-275.

Fabling, R. and L. Sanderson, 2013, "Exporting and Firm Performance: Market Entry, Investment and Expansion," *Journal of International Economics* 89: 422-431.

Hong, S., L. Oxley, P. McCann and T. Le, 2016, "Why Firm Size Matters: Investigating the Drivers of Innovation and Economic Performance in New Zealand Using the Business Operations Survey," *Applied Economics* 48: 5379-5395.

Le, T. and A. Jaffe, 2017, "The Impact of R&D Subsidy on Innovation: Evidence from New Zealand Firms," *Economics of Innovation and New Technology* 26: 429-452.

Maré, D. and D. Graham, 2013, "Agglomeration Elasticities and Firm Heterogeneity," *Journal of Urban Economics* 75: 44-56.

McCann, P., 2009, "Economic Geography, Globalisation and New Zealand's Productivity Paradox," *New Zealand Economic Papers* 43: 279-314.

Smith, D., J. Chen and H. Anderson, 2012, "The Relationship Between Capital Structure and Product Markets: Evidence from New Zealand," *Review of Quantitative Finance and Accounting* 38: 1-24.

Wakeman, S. and P. Conway, 2017, "Innovation and the Performance of New Zealand Firms," *New Zealand Productivity Commission Staff Working Paper* 2017/2.